American Machinist

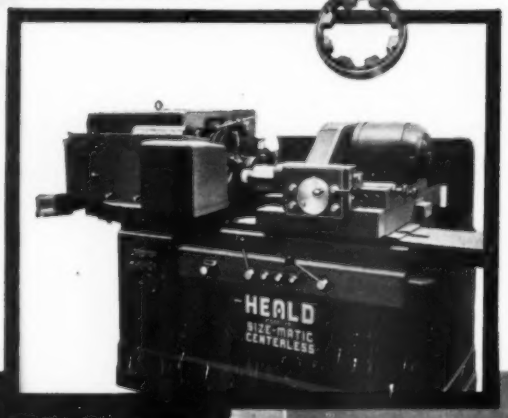
MAY 19, 1949

McGRAW-HILL MAGAZINE OF M

- [illegible] page 2
- [illegible] Choose and Use Portable Tools — FIRST OF 8 SERIES
- [illegible] Equipment, Applications

PRODUCTION OF TRANSMISSION CAMS SHIFTS INTO HIGH!

These transmission cams are precision ground on the fully automatic Model 281 Centerless shown below. All the operator has to do is keep the loading chute filled and remove the finished parts from the unloading chute.



Automotive manufacturer increases production 75% with New Heald Centerless Internals

Two Heald Model 281 Centerless Internals are now precision finishing transmission cams 75 percent faster than was possible by previous methods. The cams are of two different types—both ground on the I.D. on one machine. One type, however, has a counterbore on one side, which is ground on the I.D. and face simultaneously on the other Heald Centerless—by means of a backing plate which keeps the work in contact with the face of the wheel until the proper depth has been reached.

If you have work that can be rotated on its own O.D., why not see how much time and money you can save by doing it on a Heald Centerless Internal? Your nearest Heald representative will be glad to help you.

THE HEALD MACHINE COMPANY
Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit
Indianapolis • Lansing • New York

HEALD

PRECISION INTERNAL AND SURFACE GRINDERS

PRECISION BORE-MATIC FINISHING MACHINES

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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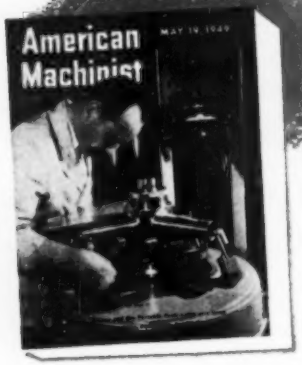


Chips and Quips

Our Cover . . . Five close tolerances on three arms of a propeller spider are checked simultaneously at Hamilton Standard Propellers. Green and red lights on the indicating board quickly indicate whether or not the part is to size. They are activated by a receiver-type electric limit gage.

Putting-on Tool . . . About 18 years ago, we published one of the first articles on sprayed metal. We compared it then with the legendary "putting-on tool" that every machinist apprentice seeks. . . . Associate Editor Rowan has just completed 12 pages describing the process. It isn't simple any more, or primarily for coating baby's first shoes. Now it's a tool, with many applications and capable of handling many materials. You'll find details in our current Special Report, drawn from many sources and double-checked as usual.

Conferences . . . Most executive conferences degenerate into ordinary "bull" sessions—unless somebody runs them properly and keeps them interesting. Alfred Cooper describes proper methods to assure a successful series of conferences on administering the human factor—today's top problem.

Lubricants . . . Lubricants are usually considered so commonplace that little attention is paid them. This can be a grave mistake. To help avoid it, we give you in this issue the feedbox information on how Fafnir tests greases—methods which you can readily adapt for your own use, with the assurance they're authentic and authoritative.

Hard to Keep . . . We've had more than the usual number of letters lately, asking for additional copies and tearsheets, and complaining that the author's copy of the issue or article has vanished into the great blue yonder. . . . Flatters us to feel it's that hard to hang on to the data—particularly when we've been collecting it for so many months or years that the editor responsible feels he'll never get rid of it.

Quick Action . . . These days, handling can cost more than machining. Fred Worley, works manager of the West Allis Tractor Works of Allis-Chalmers, describes how they use quick-acting fixtures to cut handling time . . . From the same plant, we have a description of an air press that trims segment bevel gears, this story, written by Paul Bludeau, being a "shorty," in pictures and captions. . . . Another smart handling job, this time feeding couplings to a headstock chuck in a lathe, is detailed by George E. Fogarty, vice-president at Seneca Falls Machine Co.

Induction . . . There's much to be said about induction heating these days, because of the many types of new installations. In this issue, for example, James H. (Bert) King, general supt. at Reed-Prentice, shows a fixturized induction soldering setup on steel tube that does a cleaner, quicker and stronger job. . . . And out at Stewart-Warner, Henry Orth, foreman in Heat-Treat, shows a mechanized operation, with an induction coil heating autofed stock to a press that cuts and forms circular magnets. The operator can control the whole setup from one position.

Bolting . . . To cut down the misunderstandings that mess up bolted assemblies, M. F. Spotts has put together for us a series of tips. They are illustrated by four case studies that clarify the problems in detailing and inspecting parts for bolted assemblies, point a way to solution of a common problem involving product designers, tool engineers and inspectors.

Coming . . . June 2 *A.M.* will include our second Special Report on Color in the Shop—this one bringing up to date the material we presented two years ago. As before, it will be illustrated with 4-color process photographs. There will also be articles on foundations for hammers, abrasive belts, floating holders, die fences, br .ching fixtures, and similar subjects.

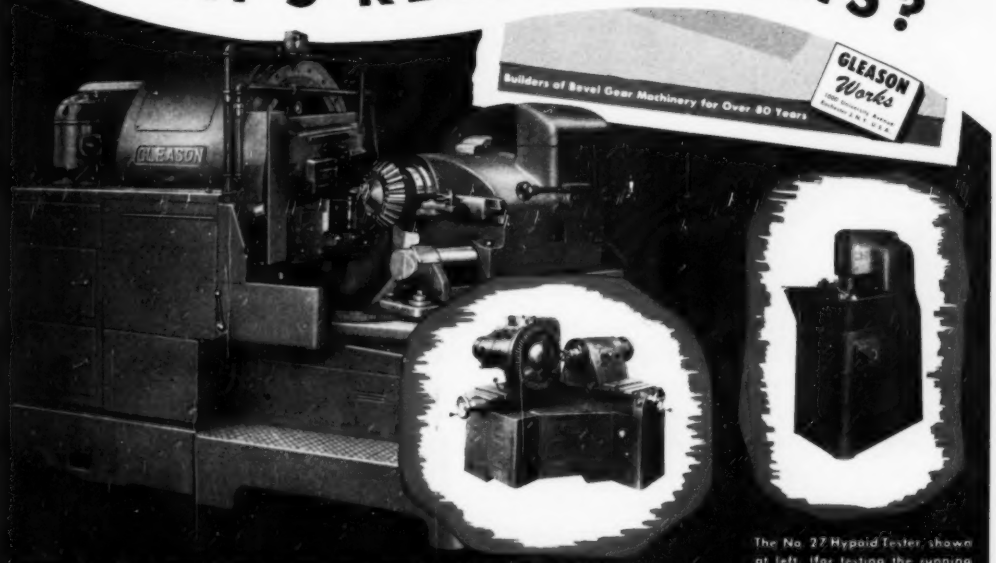
PORTABLE TOOL EXPERT . . . H. P. Bailey, 57, went to work for Warner & Swasey as soon as he got his A.B. from Oberlin in 1913. When he left, after 23 years, he had worked his way up to assistant to the president. He's been president of the Rotor Tool Company since 1927, and active in the Compressed Air Institute and other societies. That's weekdays; weekends he sails and takes pictures, even descends to golf on occasion.

We asked Mr. Bailey to put together a real story on portable tools, which to use where, and when. The result is a series of ten articles that begin in this issue under the general title, "How to Choose and Use Portable Tools." The first installment deals with the economic approach, discusses actual costs.

In August, 1946, Gleasons announced localized tooth bearing in straight bevel gears and called this new development "Coniflex.*"

NOW IT'S LOCALIZED TOOTH BEARING for STRAIGHT BEVEL GEARS

ARE YOU EQUIPPED FOR TODAY'S REQUIREMENTS?



Today, Coniflex gears have proven superior to ordinary straight bevels. They are easier to assemble, operate smoother, and have wider operating tolerances. Coniflex gears, as cut on the No. 24A Straight Bevel Generator, are providing outstanding operation in power shovels and cranes, road machinery, ordnance and mining equipment, steel mill table drives and other heavy equipment.

For large gears, investigate the Gleason No. 24A Straight Bevel Generator . . . designed to cut the new Straight Bevels, Coniflex.

* Coniflex—Straight bevels with localized tooth bearing. Reg. U. S. Pat. Off.

The No. 27 Hypoid Tester, shown at left, (for testing the running qualities) and the No. 12 Generator Tool Sharpener, shown above, (to sharpen the cutting tools) complete the unit for complete production of Coniflex gears

GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U. S. A.

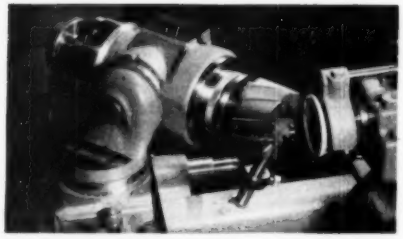
Builders of Bevel Gear Machinery for Over Eighty Years

CINCINNATI NO. 2 CUTTER GRINDER

Sharpens a wide variety of cutters

CINCINNATI No. 2 Cutter and Tool Grinder sharpening a large taper reamer.

There's no better machine to sharpen a wide variety of railway shop cutters than a CINCINNATI No. 2 Cutter and Tool Grinder. This machine has many features, and extra attachments, too, for sharpening an exceptionally wide variety of cutters. Three extremes are shown here: a large taper reamer, a lathe tool, and a shell end mill. Cincinnati's sensitive antifriction table traverse is highly desirable for all of these jobs, and its rugged construction is an absolute necessity for heavy parts like the large taper reamer. Other features provide the flexibility required for sharpening face mills, slab mills, interlocking cutters, taps, planer and shaper tools, etc. For railroad shops, the machine can be arranged with 36" table traverse, more than double standard figure. Write for catalog M-1618-1. It contains complete information on this versatile cutter and tool grinder.



Sharpening the corner of a shell end mill on a CINCINNATI No. 2 Cutter and Tool Grinder.

Sharpening a lathe tool on a CINCINNATI No. 2 Cutter and Tool Grinder.

THE CINCINNATI MILLING MACHINE CO.

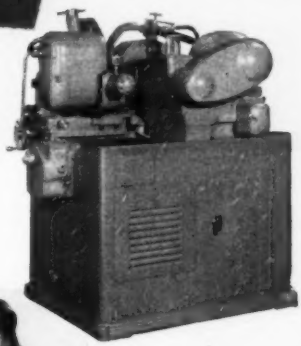
CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

these parts precision ground on CINCINNATI FILMATIC NO. 0 CENTERLESS

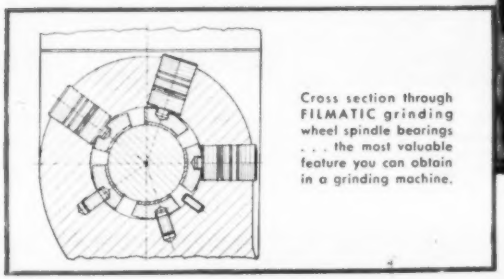
From left to right the above parts are: Shaft; balance staff; No. 55 drill; synthetic ruby; spring; dentists' drill; stud.

Regulating wheel unit . . . no gears to change; no levers to shift. Just rotate the hand-wheel to the speed desired.



Rear view reveals smooth trim lines; built-in electrical equipment; floor space only 16 sq. ft.

● One way to push down the cost of small parts is to make them on machines which are not overpowered nor too large. Look at the parts illustrated above. All of them were precision ground on a machine designed for this type of work—CINCINNATI FILMATIC No. 0 Centerless. Powered at the grinding wheel by a 2 hp motor, these machines have a capacity of 0 to ½" diameter by 4" (thrufeed) or 5" (infeed) length. Three features are illustrated at the right. Would you like to know more about CINCINNATI FILMATIC No. 0 Centerless? Ask for catalog G-576.



Cross section through FILMATIC grinding wheel spindle bearings . . . the most valuable feature you can obtain in a grinding machine.

They're built for operators who like to work while seated.

FILMATIC

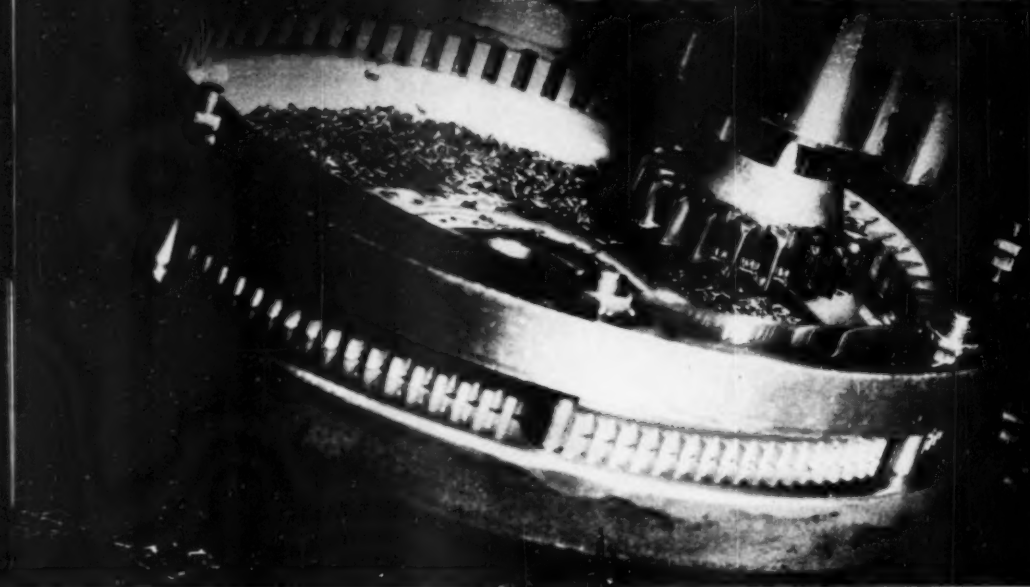
CINCINNATI

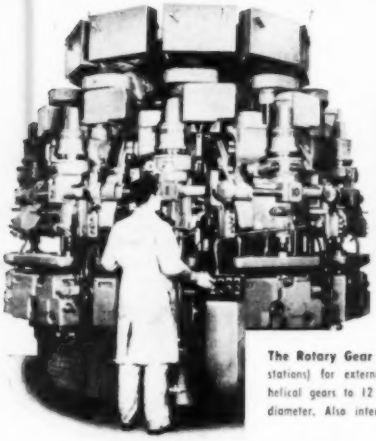
CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

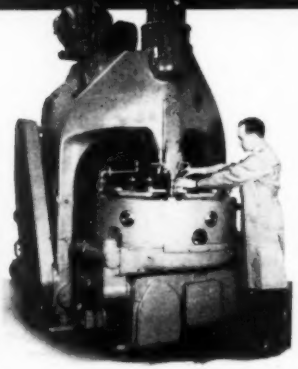
CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

GOOD GEARS



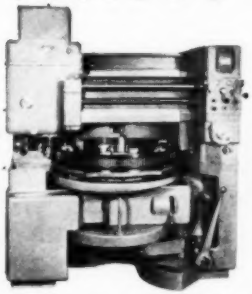


The Rotary Gear Shaper (10 stations) for external spur and helical gears to 12 inches pitch diameter. Also internals.



The Planetary Gear Shaper (6 work-spindles) for external spur and helical gears and pinions to 3½ inches pitch diameter.

FELLOWS GEAR-



The 36-inch Heavy-Duty Gear Shaper for intermediate and large size gears, and face widths up to 6 inches.

The 3-inch Fine Pitch Gear Shaper for small external and internal spur and helical gears. Often with magazine feed.

THE FELLOWS GEAR SHAPER COMPANY, Head Office & Export Dept., Springfield, Vermont.
Branch Offices: 616 Fisher Bldg., Detroit 2, Mich. • 640 West
Town Office Bldg., Chicago 12, Ill. • 7706 Empire State Bldg., New York 1, N. Y.

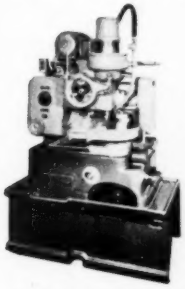
. . . . cheaper to produce

with FELLOWS' LATEST

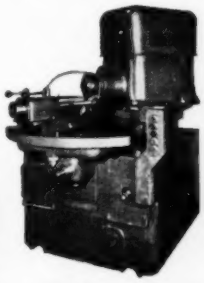
The late-model Fellows Machines offer the gear shop a major production advantage over older-type tooling. Increased stock-removal-capacity is offered in the large, medium and small machines, alike. Finer finish is achieved through still greater rigidity of work and tool relationship. Operating attendance costs come down with the rising importance of multiple-spindle machines.

Coordinated gear production operations may involve any combination of the machines and instruments shown below. Literature is available on all types. An inquiry addressed to the office nearest you will bring up-to-the-minute information of any kind, either general or specific.

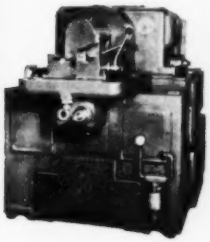
CUTTING ★ SHAVING ★ INSPECTION



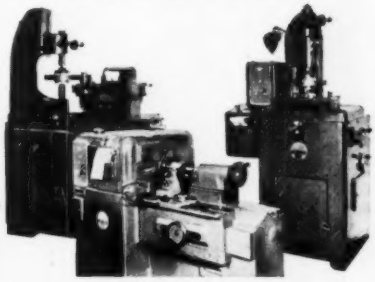
The 7-Type Gear Shapers for general service on external and internal spur and helical gears up to 7 inches.



The Full-Tool Shaving Machine for finishing external spur and helical gears up to 8 inches pitch diameter.



The No. 11 Gear Shaving Machine for finishing internal gears, both spur and helical, capacity dependant upon tool and fixtures.



The Inspection Instruments for (a) Involute measuring of tooth profiles (b) Lead measuring for the checking of lead, crown, and taper (c) "Red Liner" for inspection of errors in combination. All instruments are provided with automatic recording devices.

Fellows

You Get

Out More Work... Cut Setup Time

WITH THE VAN NORMAN NO. 22L RAM TYPE MILLER

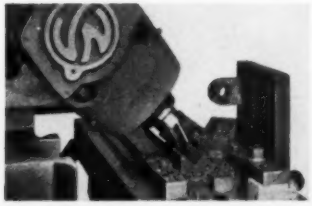
Here's a versatile miller that meets practically all milling requirements. The adjustable cutterhead enables you to perform conventional horizontal or vertical, as well as angular milling, with one machine. It saves set-up time because most jobs can be carried through to completion without changing the work set-up.

The movable ram in combination with the saddle cross feed increases the work range, enables you to handle larger work.

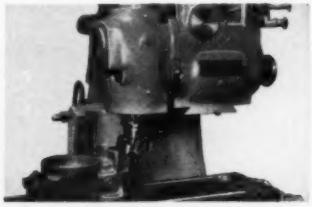
Front and rear direction controls, large dials on the hand adjustments, quick-change speed and feed selectors simplify operation . . . reduce operator fatigue.

The Van Norman No. 22L is available with plain or universal saddle. Investigate this miller as well as other Van Norman Ram Type and Horizontal Millers today. They will help you speed production and cut your milling costs. Write for catalog describing these versatile millers.

HORIZONTAL MILLING— With the head locked in the horizontal position, the 22L mills a slot in the workpiece. Hardened stop set at factory assures positive 0° setting.



ANGULAR MILLING— Milling a "V" in the workpiece. Note that the work is still in the original setup . . . saving setup time and assuring accuracy.

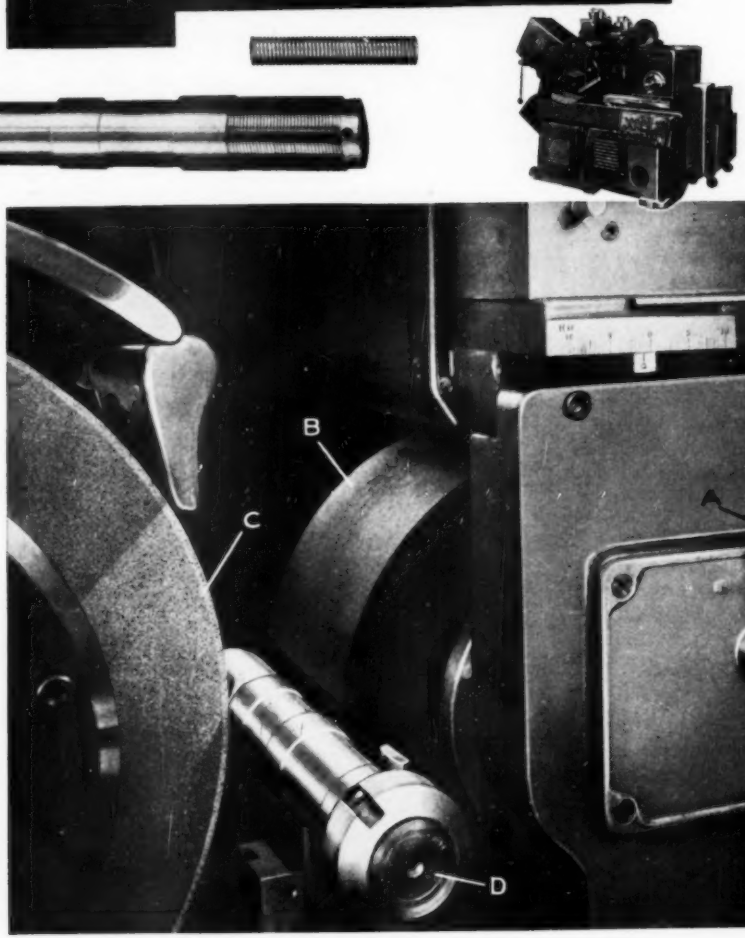


VERTICAL MILLING — Face milling operation with cutterhead in vertical position. Permanently fixed hardened stop permits easy setting of cutterhead at 90°.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

UP-CUTTING A NEW



A—Infeed Control Lever; B—Regulating Wheel; C—Grinding Wheel; D—Diesel Engine Bolt.

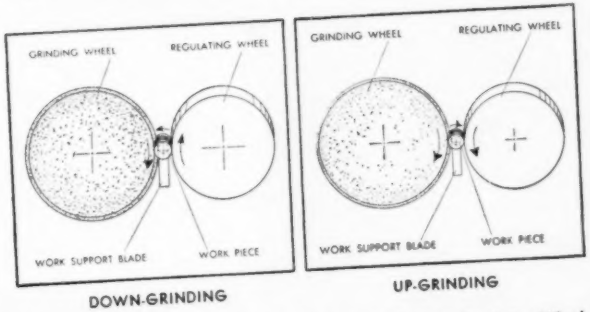
LANDIS *Machine* COMPANY

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD

Centerless Thread Grinding TECHNIQUE

GREATER WORK SURFACE SPEED — BETTER THREAD FINISH

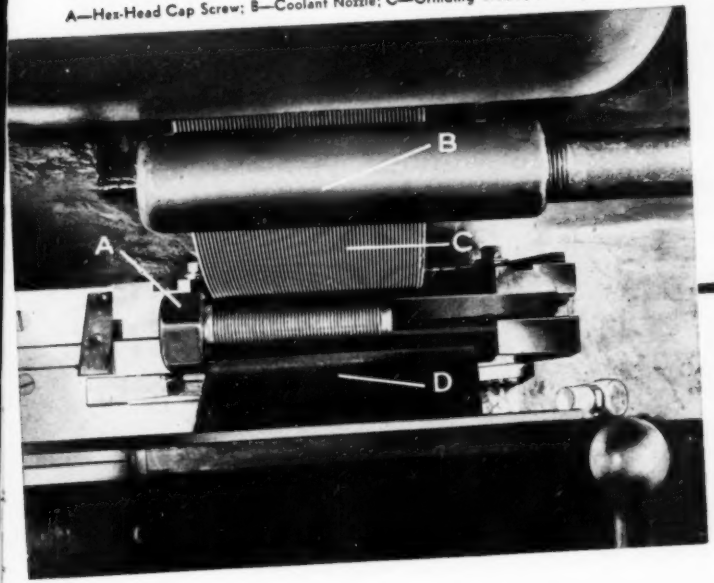
• Engineering research in our laboratories has developed a revolutionary new technique in centerless thread grinding—"up-cutting." The difference between "up-cutting" and "down-cutting," the method generally used for centerless cylindrical grinding and centerless thread grinding, is illustrated diagrammatically below. The new technique is generally to be used for infeed grinding and for large workpieces requiring coarse-pitch threads.



In "down-cutting," the surfaces of the workpiece and grinding wheel move in the same direction at the point of contact. In "up-cutting," the surfaces of the workpiece and grinding wheel move in opposite directions at the point of contact. Stresses imposed are reduced and work surface speeds can be used up to 30% greater than for similar "down-cutting" conditions, with fewer wheel dressings. All forces act downward, holding the workpiece firmly on the workrest blade and reducing chattered finishes under heavy cuts. The regulating wheel solely controls work rotation and the end-wise travel in timed relation to its rotation, completely independent of friction between the grinding wheel and the workpiece. Spinning of the work is practically eliminated, especially when grinding coarse threads on heavy workpieces.

Write for Bulletin E-97

A—Hex-Head Cap Screw; B—Coolant Nozzle; C—Grinding Wheel; D—Regulating Wheel.



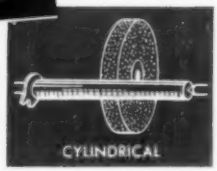
WAYNESBORO PENNA. U. S. A.

GENERATING EQUIPMENT

Your Best Buy in Small Grinders

2 machines in One

12" x 28" UNIVERSAL and TOOL GRINDER

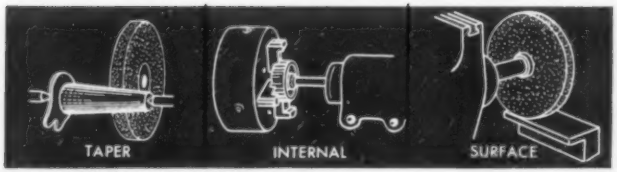


Write for Catalog K45 for full information on the 24 different grinding operations that can be performed on this versatile machine both as a universal grinder and as a tool and cutter grinder. It includes specifications and features of this machine together with setup pictures of typical grinding operations.

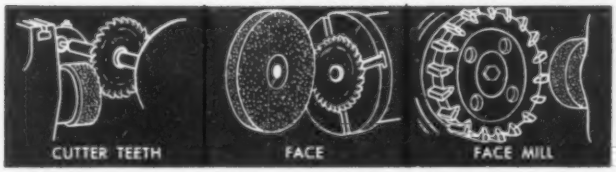
LANDIS TOOL *Precision Grinders*

SPECIALLY DESIGNED FOR WET OR DRY GRINDING

The coolant tank and drain troughs are integral parts of the bed casting. All operating mechanisms are thoroughly protected to eliminate abrasive material resulting from dry grinding operations.



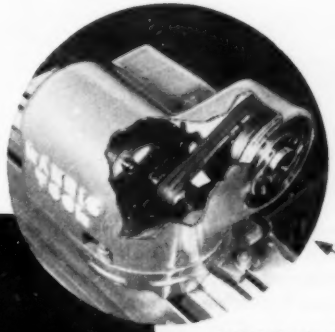
A UNIVERSAL GRINDER + A TOOL AND CUTTER GRINDER =



LANDIS TOOL
12" x 28" UNIVERSAL and TOOL GRINDER

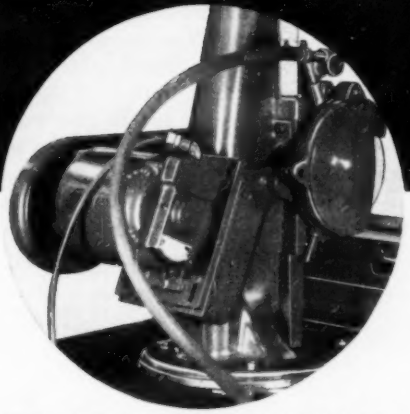
LOW CAPITAL INVESTMENT...You really get two machines in one with the 12" x 28" Universal & Tool —an ideal one machine grinding department for the tool room or small shop at a big saving in capital investment over separate machines.

WITH PLUS FEATURES



COMPACT ALL VEE-BELT HEADSTOCK

Low compact headstock particularly good for face grinding operations. All Vee-belt drive assures smooth power and fine finishes. Only two revolving parts; the electric motor and face plate or spindle.



RIGID MOTOR MOUNTING ON MASSIVE COLUMN

The motor is adjustable for changing belt tension. Column made with heavy sections, well ribbed. Vertical ways protected under wheel head by telescoping guides.

53

LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

NEW ADDITION

CROCKER-WHEELER MADE MOTOR NEWS THEN . . .

1894 . . . *the first electrified printing plant in the world* is installed (for the New York Life Insurance Company) by Crocker-Wheeler. Soon C-W motors were in use in the Government Printing Office in Washington, the Bureau of Printing and Engraving, the United States mint in Philadelphia. This early Crocker-Wheeler driven machinery was to be the forerunner of the modern high speed printing press.

and CROCKER-WHEELER IS MAKING MOTOR NEWS *today*

C-W WOUND-ROTOR MOTORS

From 1 to 2000 hp.

Now Crocker-Wheeler brings you a streamlined Protected-Type WOUND-ROTOR Motor with all the up-to-the-minute advantages of the popular C-W Protected-Type Squirrel-Cage Induction Motors.

Users of C-W Protected-Type Squirrel-Cage Motors know well the advantages of Crocker-Wheeler design . . . and the many mechanical modifications which make these standard motors so versatile. Now the *same* advantages are available in wound-rotor motors.

For printing, conveying, ventilation and other services that require smooth acceleration, high starting torque with low starting current, ability to start and stop or reverse frequently, or variable speed, these new C-W motors will provide unexcelled performance.

Sizes from 1 to 2000 h.p., and an exceptionally wide choice of mechanical modifications, answer practically all application problems. You may have splash-proof and totally-enclosed non-ventilated, as well as the protected-type design. Choose from vertical, NEMA D flange or C face mountings and all standard NEMA floor, or ceiling mounting assemblies. Special windings are available for crane and hoist duty.

The excellence and motor know-how built into C-W Wound-Rotor Motors is clearly explained in the new Bulletin SL-330-1. Mail coupon for your copy. *Now.*

IF CROCKER-WHEELER BUILDS IT, IT'S A BETTER BUILT MACHINE

Protected-Type Induction Motors Vertical or Horizontal

Totally-enclosed, fan-cooled Motors

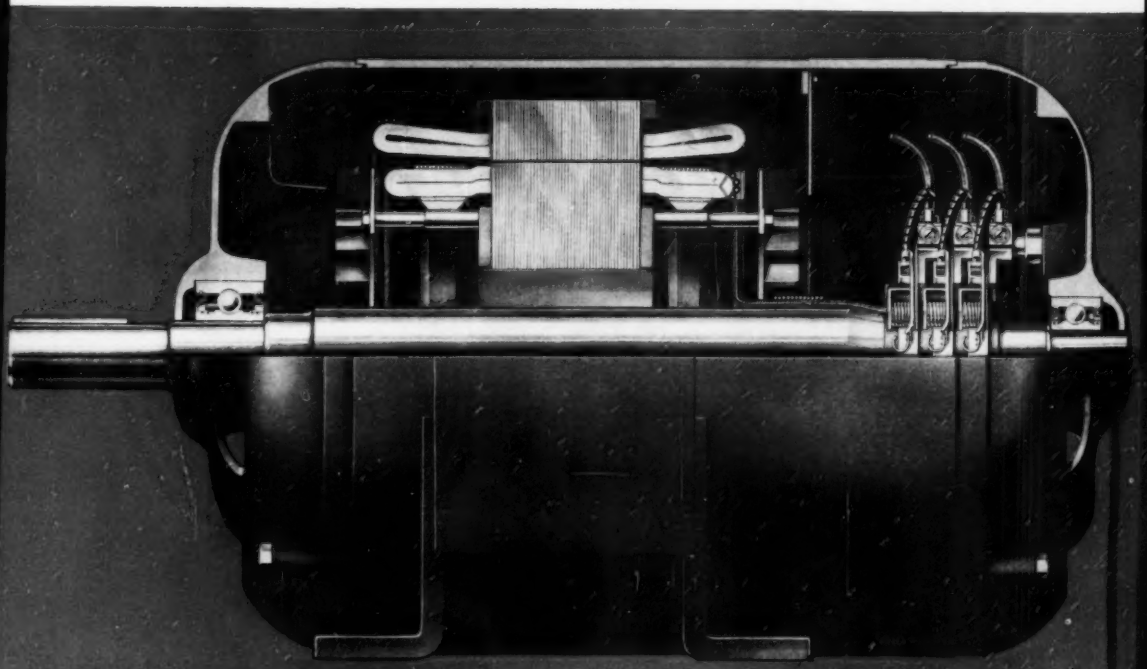
A-C Generators and High Speed Synchronous Motors

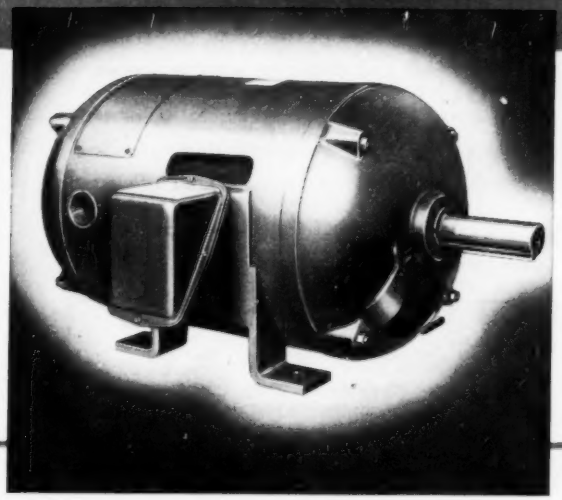
Large D-C Motors and Generators

Turbogenerators

OTHER C-W PRODUCTS TO SERVE YOUR NEEDS: A-C Induction Motors, 1 to 2000 hp; SEALED-POWER totally-enclosed, fan-cooled motors, 1 to 50 hp.; High Speed Synchronous Motors; D-C Motors, 1 to 5000 hp.; A-C Generators, high speed and low speed; Turbogenerators, 1562 to 18,750 kva; D-C Generators, 1 to 2000 kw; Motor Generator Sets, A-C and D-C, 1 to 5000 kw; Steel Mill Motors, up to 200 hp for auxiliary drives, also Heavy-duty Motors up to 2000 hp for main drives; Flexible Couplings, Pulleys, Motor bases; Motordomers, 1 to 50 hp.

to Protected-Type line----





Better Built because---

Frames and endshields dripproof—keeps dripping liquids and falling chips out of windings.

Louvered openings on both sides of frame for maximum cooling, with effective protection.

Air guides distribute cooling air effectively.

Stator and rotor coils of vinylacetal insulated wire, protected by thoroughly-baked thermosetting varnish for maximum rigidity and long-lasting protection against electrical failure.

Slip rings cast of special composition bronze for long life, mounted on steel hub, insulated from hub by mica sleeve.

NEMA frames 364-505 have heavy rolled steel frame for strength. Sturdy welded feet.

Full details of the many other fine points of these motors are included in the new Bulletin now available. Send coupon.

CROCKER WHEELER

ELECTRIC MANUFACTURING COMPANY, AMPERE 3, N. J.

A Division of The Joshua Hendy Corporation

Branch Offices:
Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Houston, Los Angeles, Milwaukee, New York, Philadelphia, San Francisco, Pittsburgh, Washington, D. C.
Representatives in principal cities.

Crocker-Wheeler Electric Mfg. Co.
Ampere 3, N. J.

Please send new Bulletin SL-330-1, describing Crocker-Wheeler Protected-Type Wound-Rotor Motors. AM-549

Name.....

Title or Function.....

Company.....

Address.....

"PACKAGED POWER"

That's Shockless—Trouble-Free!

LINK-BELT *Electrofluid* GEAR DRIVES WITH SILVERLINK ROLLER CHAIN

The Ideal Slow Speed Drive

The advantages of the Electrofluid Drive are available on virtually any power application through combination with other Link-Belt enclosed gear and chain drives. Above is shown one such combination which will afford shock-proof, economical power transmission at low speed.

Three principal advantages of this drive are:

(a) It provides smooth power transmission, assuming the load gradually and eliminating shocks which could damage material in process.

(b) It prevents damage to costly power-driven equipment and eliminates work stoppages.

(c) It permits the use of a smaller motor than ordinarily required to handle starting loads—improves power factor and overall efficiency.

Ask for Book No. 2085-A giving full details and application suggestions.

TYPES OF LINK-BELT Power Transmission Machinery

- Silverlink Roller Chain
- Silverstreak Silent Chain
- Steel and Malleable Chain
- Worm Gear Drives
- Herringbone Gear Drives
- Helical Gear Drives
- Gearmotors
- P.I.V. Variable Drives
- Fluid Drives
- V-Belt Drives
- Ball Bearings
- Roller Bearings
- Babbitted Bearings
- Couplings, Clutches, Collars, etc.

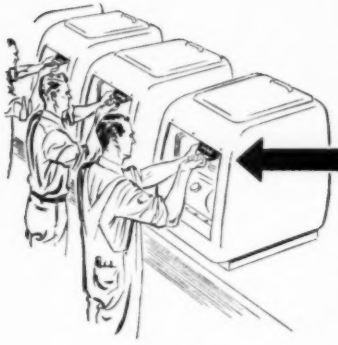
LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities. 11,237

LINK-BELT

Power Transmission Machinery

"THE COMPLETE LINE"

Build-in **Veeder-Root** Counters and Build Up Your Product's Sales!



Veeder-Root Counters can be *engineered into the design* of almost all types of machines, from addressing to vending.

These counters do countless things, depending on the application and its peculiar requirements. They add new usefulness to a product—new merchandising appeal. They help prove the product's service guarantee, sometimes even help the customer pay! They help prevent errors, delays, shortages, overruns, waste, danger. They help provide an equitable basis for wage payment and incentives. Or they can help to co-ordinate production and work-schedules more closely—as well as anticipate maintenance needs.

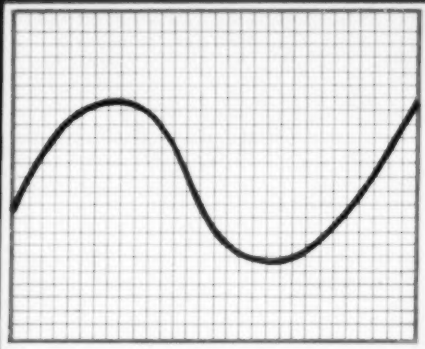
Those are a few of the jobs being done every day by Veeder-Root *Count*rol. *How?* That's for us to tell *you!* So if you want to count your way to greater sales and profits—*write.*

VEEDER-ROOT INCORPORATED, HARTFORD 2, CONNECTICUT

In Canada: Veeder-Root of Canada, Ltd., 955 St. James St., Montreal 3.
In Great Britain: Veeder-Root Ltd., Kilspindie Rd., Dundee, Scotland.

Veeder-Root COUNTERS

Better Form · Better Finish *and* More Production *from the*



The Norton "wide-range," automatically compensating work speed arrangement operates at an ever changing rate—providing the most efficient work speeds for stock removal and for fine finish.

Backing this fine feature is the new Norton "metal-to-metal contact type" wheel feed and sizing mechanism—plus a silky-smooth operating cycle—plus the ultra-enduring Norton Wheel Spindle Unit.

Automatic features drastically reduce manual effort. They insure product quality and permit operators to tend two or more machines.

Hinged Wheel Guard cover plus close-approach rear base design greatly eases wheel change.

Major electrical controls close-grouped in accessible enclosing cabinet for maximum ease in maintenance.

Abrasives · Grinding Wheels · Honing and Lapping Machines · Refractories · Porous Mediums · Non-slip Floors · Norbide Products · Labeling Machines

NORTON No. 2 Cam-O-matic Grinder

YES, you get a better product—*faster*—with the Norton No. 2 CAM-O-MATIC Cam Grinder—for, among other things, a high degree of operating skill is built right into this machine.

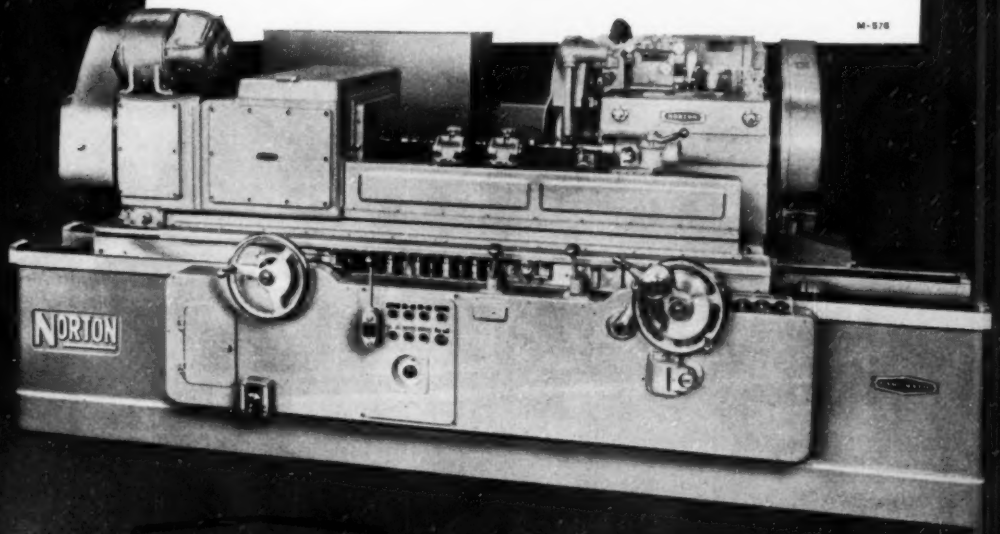
For example, its wide-range, automatically compensating work speed provides initially the ideal speed for rapid stock removal—then tapers gradually to the ideal speed for finishing—as each cam is being ground.

The operating cycle—in which split seconds are utilized—reduces lost motion to the minimum. All indexing—for work or master cam positioning—is ultra-smooth yet rapidly efficient. Wheel slide travel at each cam change—which occurs normally around 300 times per hour—is measured in thousandths of an inch each time as against inches in previous models. A fluid, shockless functioning that confers long-life benefits is particularly noticeable throughout the operation of the machine.

Yes, this new Norton CAM-O-MATIC grinder will give you dividends in increased production—and dividends in lower overall costs. And it offers more maintenance and serviceability advantages than any equipment hitherto available for the job.

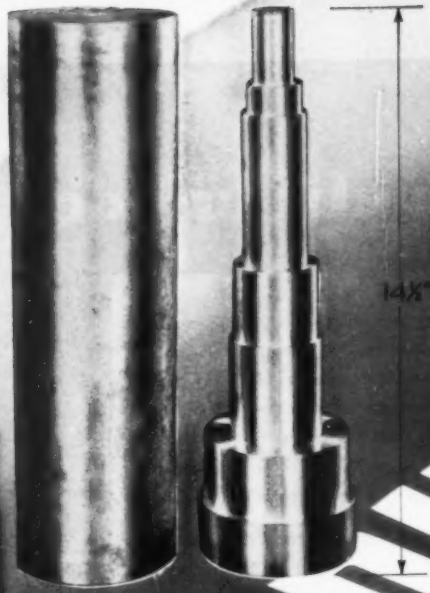
A brand new catalog—Number 195—is on the press. Write for a copy.

M-576



NORTON GRINDERS and LAPPERS

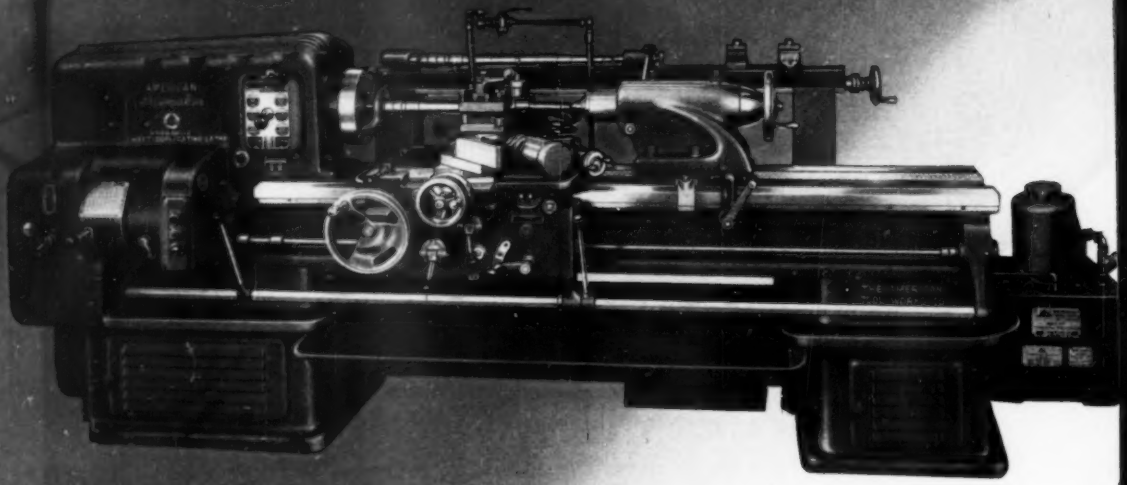
NORTON COMPANY WORCESTER 6, MASS.



- Duplicator Time **14** Minutes
- Former Time **48** Minutes

Material . . . . . 4¼" SAE 4140
Depth of Cut . . . . .½"
Speed . . . . . 255 f.p.m.
Feed . . . . . .018"
Total Time,
floor to floor . 14 minutes

PRODUCTION COSTS



THE AMERICAN TOOL WORKS CO.

SHATTERED

. . . by the new Hydraulic Duplicating technique introduced by "AMERICAN"

4¼" step shaft of SAE 4145 steel being machined complete in 14 minutes on 16-inch "American" "H S-D" Lathe.

The new "American" Hydraulic Shaft-Duplicating Lathe is a thoroughly engineered development for reproducing work shapes from a template by means of a hydraulically controlled cutting tool. The template holder and tracer head are built in at the rear of the lathe where they will not obstruct the operator's vision of the work or interfere with loading and unloading. All operating controls are located at the front of the lathe.

It is faithful and accurate in its reproduction.

It will reproduce steps, tapers, right angle and tapered shoulders, recesses, grinding necks and radii and is especially adapted to the production of such work as spindles, motor shafts, valve stems, back shafts, piston rods, axles—and a wide variety of chuck work having irregular contours.

A single hydraulic system is employed for operating the hydraulic tracer valve and the piston which controls the movement of the tool slide carrying the cutting tool. This simplicity is an outstanding feature and insures accurate reproduction, freedom from failures and elimination of work rejects.

This new metal cutting technique permits continuous cutting without interruption for measuring or calipering at feeds and speeds to the cutting limit of Cemented Carbide tools. "Miking" is confined to the first diameter only after which all other diameters are secured automatically.

This machine may be quickly converted to standard lathe operations.

Descriptive Bulletin No. 35 sent upon request.

Cincinnati, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

THE BIG SWITCH IS BECAUSE THEY CUT

Here's picture-proof of why shops everywhere are turning to new Kearney & Trecker Knee-Types with Automatic Table Cycle and Mono-Lever Control. Job shown is reciprocal milling on a Kearney & Trecker 30 hp No. 3 CSM machine with Automatic Table Cycle and Mono-Lever control. Using Automatic Table Cycle, machine turns out hundreds of these forged parts with operator merely loading and unloading workpieces. Actual savings on this job — 31%!

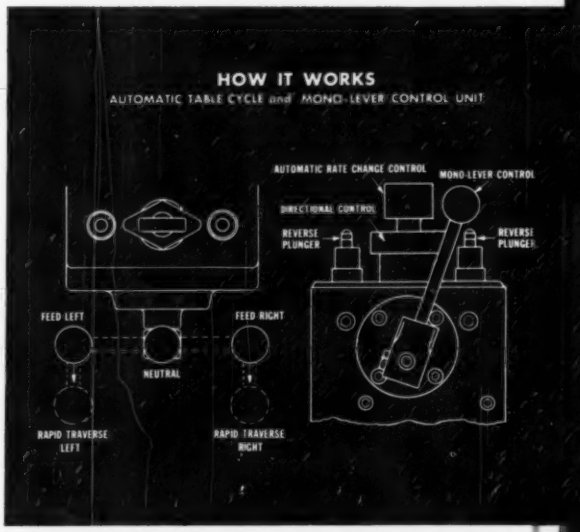
TO THESE MACHINES CYCLE TIME UP TO 31%

YES, cost-minded, profit-conscious shop men are buying new Kearney & Trecker standard knee type milling machines. Why? Because no others offer the cost-cutting combined features of Mono-Lever Control with Automatic Table Cycle.

These features reduce hand control of the table to the *movement of one lever!* This means big reduction of idle cutter time — less operator fatigue—and *more production per hour.* What's more, Mono-Lever Control and Automatic Table Cycle combine the automatic, high production capacity of bed type design with the versatility of knee types.

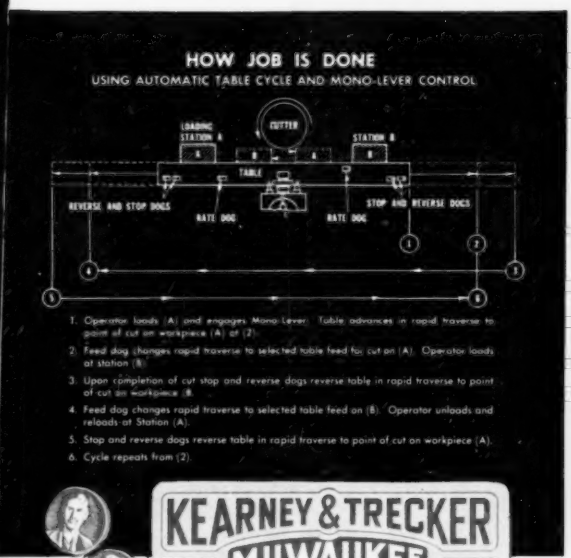
Equally important is the opportunity for proper machine selection. You neither *over-buy* nor *under-buy*, but you buy *right* when you choose from the 56 machines in this new line.

For some startling facts about these machines and their application to your milling work, consult a Kearney & Trecker Sales Representative today. Schooled in the "know-how", he's at your service. Contact him or write us direct. Ask for Catalog No. AC-10A. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

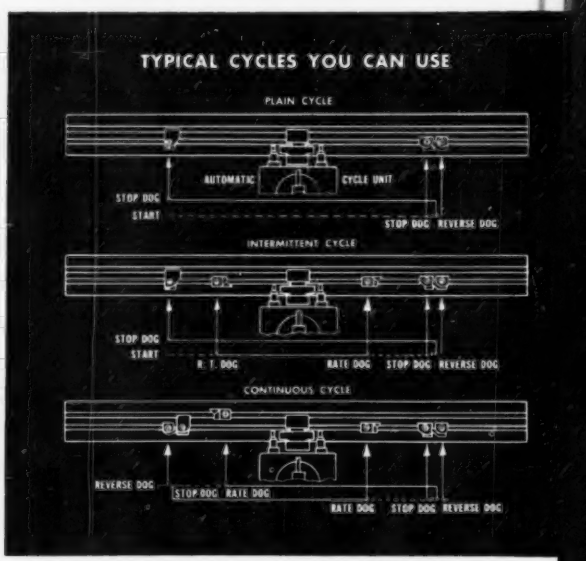


LOOK AT THE JOB below — the diagram tells how it's done. Table feed screw with adjustable nut eliminates backlash, so climb and conventional cuts are taken with equal ease. Cycle pre-set to fit operator's required load and unload time.

THINK OF IT! Now you can have all the advantages of this great cost-cutting feature plus the all-around versatility of general purpose, knee-type machines . . . faster, easier control for greater production with less operator fatigue.


HOW JOB IS DONE
USING AUTOMATIC TABLE CYCLE AND MONO-LEVER CONTROL
LOADING STATION A
CUTTER
STATION B
TABLE
REVERSE AND STOP DOGS
RATE DOG
RATE DOG
STOP AND REVERSE DOGS
1. Operator loads (A) and engages Mono-Lever. Table advances in rapid traverse to point of cut on workpiece (A) at (2).
2. Feed dog changes rapid traverse to selected table feed for cut on (A). Operator loads at station (B).
3. Upon completion of cut stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (B).
4. Feed dog changes rapid traverse to selected table feed on (B). Operator unloads and reloads at Station (A).
5. Stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (A).
6. Cycle repeats from (2).

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS



THREE DIFFERENT TYPICAL CYCLES to accommodate various job setups. Using the completely automatic cycle feature effects savings of up to 31% for lots of 10 or more pieces. Cycle can be set for loading and unloading time — and can be reversed in feed or rapid traverse.

Built to maintain **P&W** *precision*

The STANDARD by which all fine Lathes are judged

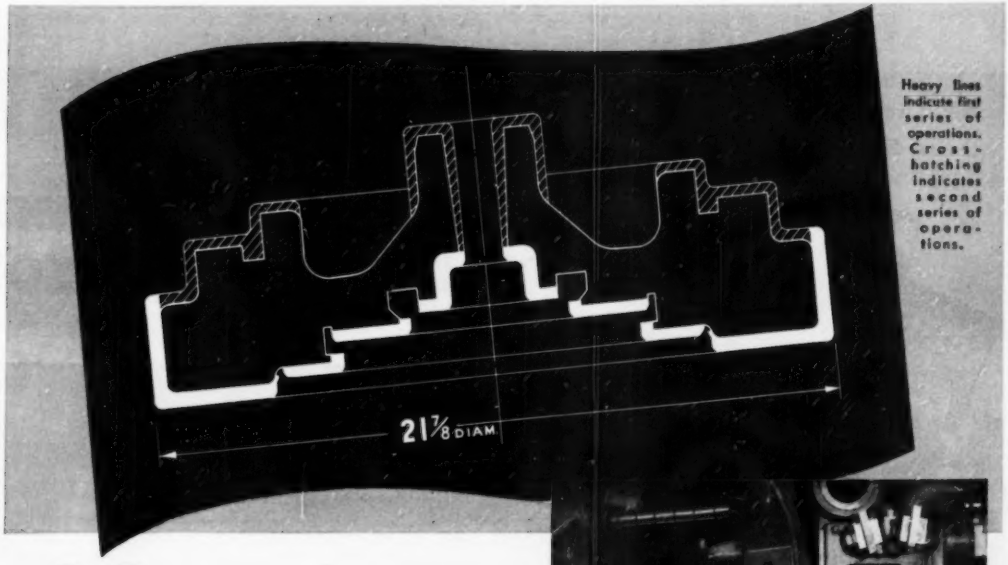
12 INCH • 14 INCH • 16 INCH

Bulletin describes all features. Write for your copy

Pratt & Whitney

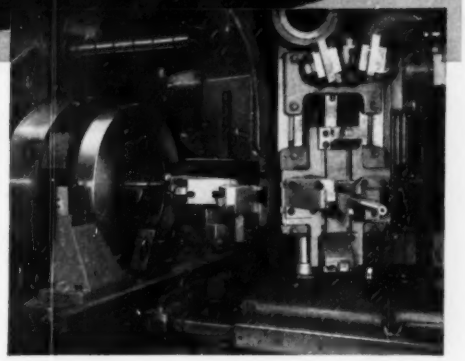
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

Model "C" LATHE



Heavy lines indicate first series of operations. Cross-hatching indicates second series of operations.

32 OPERATIONS ON TWO P&J AUTOMATICS IN 17.05 MINUTES WITH P&J TOOLING



P&J tool engineers have the extensive background of experience to recommend the most economical Automatic Turret Lathe — plus the most effective tooling — for any job — especially for one that calls for a series of intricate chucking operations. Witness this heavy duty flywheel job: one operator, running two Automatics, machines the first series of operations (heavy lines in the drawing) in 17.05 minutes, and the second series (cross-hatched lines) in 12.20 minutes — delivering a finished piece every 17.05 minutes. How else would you, *could* you, do this work so efficiently? Send prints or sample parts for a P&J estimate.

1st SERIES OF OPERATIONS — HUB END TO SPINDLE

1st TF — Rough turn dia. Rough bore 2 dias. . . . Broadface bottom. Broadface dia. . . . Spade clutch face for slide tool.

2nd TF — Rough face web. Rough face open end.

3rd TF — Finish bore 2 dias. Finish face 2 surfaces... Finish turn. Finish broadface. Chamfer.

4th TF — Finish face web.

5th TF — Size bore 2 dias.

2nd SERIES OF OPERATIONS — FINISHED END TO SPINDLE

1st TF — Breakdown taper bore. Turn hub. Bore dia.

2nd TF — Rough face at rim. Rough face dia. Rough face hub.

3rd TF — Rough ream taper hole.

4th TF — Semi finish ream taper hole. Finish turn hub. Finish face at rim. Break corners.

5th TF — Finish ream taper hole. Finish face hub.

6th TF — Size turn hub.

6 DSE AUTOMATIC TURRET LATHE

Potter & Johnston Company

Pawtucket, R. I.

subsidiary of Pratt & Whitney Division Niles-Bement-Pond Company

P&J

Send for your copies of these Sterling folders.

STE

WHERE CONTROLLED YOUR WHEELS TO

At regular intervals, Sterling's pressed wheels and segments enter continuous operation kilns for heat treatment. Here, under carefully controlled degrees of high temperatures, bond and grain are fused into grinding wheels whose superior performance is assured by this and other strict adherence to high standards of Sterling's Research and Development Program.

"THE WHEELS OF INDUSTRY"
STERLING
GRINDING WHEELS

STERLING

HEAT TREATMENT ANNEALS PRE-DETERMINED STANDARDS

UNUSUAL concern with ordinary procedures, as evidenced by our carefully regulated and controlled heat treatment, is but a part of the many desirable features of Sterling's New Research and Development Program.

Backed by years of planning, this new idea of cooperative effort between manufacturer and customer is now offering quicker, positive solution of your grinding problems. This is accomplished by Sterling's "Wheels of Industry" being especially designed for the job to be done. Tested formulas, built to the recommendation of your Sterling engineer and approval of Sterling's grinding technicians, now positively eliminate guesswork on any problems related to cutting, roughing, finishing, polishing, etc.

May we show you how Sterling Grinding Wheels, tailor-made to your needs, will do your jobs faster and more economically ?

STERLING RESEARCH AND DEVELOPMENT IN ACTION

FIRST STEP The part being ground shows excessive wear and poor finish. The Sterling engineer arrives to apply his "know-how."

SECOND STEP Skilled by years of experience, he studies both the wheel and machine to discover the hidden fault.

THIRD STEP He now replaces a worn machine-part that was causing the trouble. No need to replace wheel.

FOURTH STEP Machine and wheel will continue to work faster . . . better, thanks to the Sterling engineer's aid.

THE STERLING GRINDING WHEEL DIVISION

of

THE CLEVELAND QUARRIES CO.

TIFFIN, OHIO

Since 1885, Manufacturers of "The Wheels of Industry"

Branches: Boston, Chicago, Cleveland, Detroit, Los Angeles, Philadelphia, New York. Distributors In All Cities.

How a BALDWIN PRESS helped BROWN to .

You may see one of the heads that the Brown Steel Tank Company's Baldwin Hydraulic Press is producing, next time you pass a tank truck on the highway. Brown is a leading fabricator in this field, and its products are serving throughout the nation.

The company reports a whole parade of advantages from the use of this Baldwin 1500-ton triple action Hydraulic Press.

First—a big increase in *business opportunity* because of unlimited possibilities in product design, and the ability to work larger sheet. These expanded opportunities were immediately reflected in a substantial increase in business booked.

Second—a decided increase in shop output. Elimination of bottle-necks of slow operations permitted all shop equipment to produce to capacity.

Third—a big increase in *productivity per man-hour*. Old hand-flanging methods were slow and costly. The husky, hefty Baldwin Press now stamps, forms and flanges in one smooth operation.

Fourth—*improvement of the product* through reduction of weight, because of the possibility of re-design, came with Baldwin Press production. This permitted the steel allocation to be stretched over a greater number of jobs.

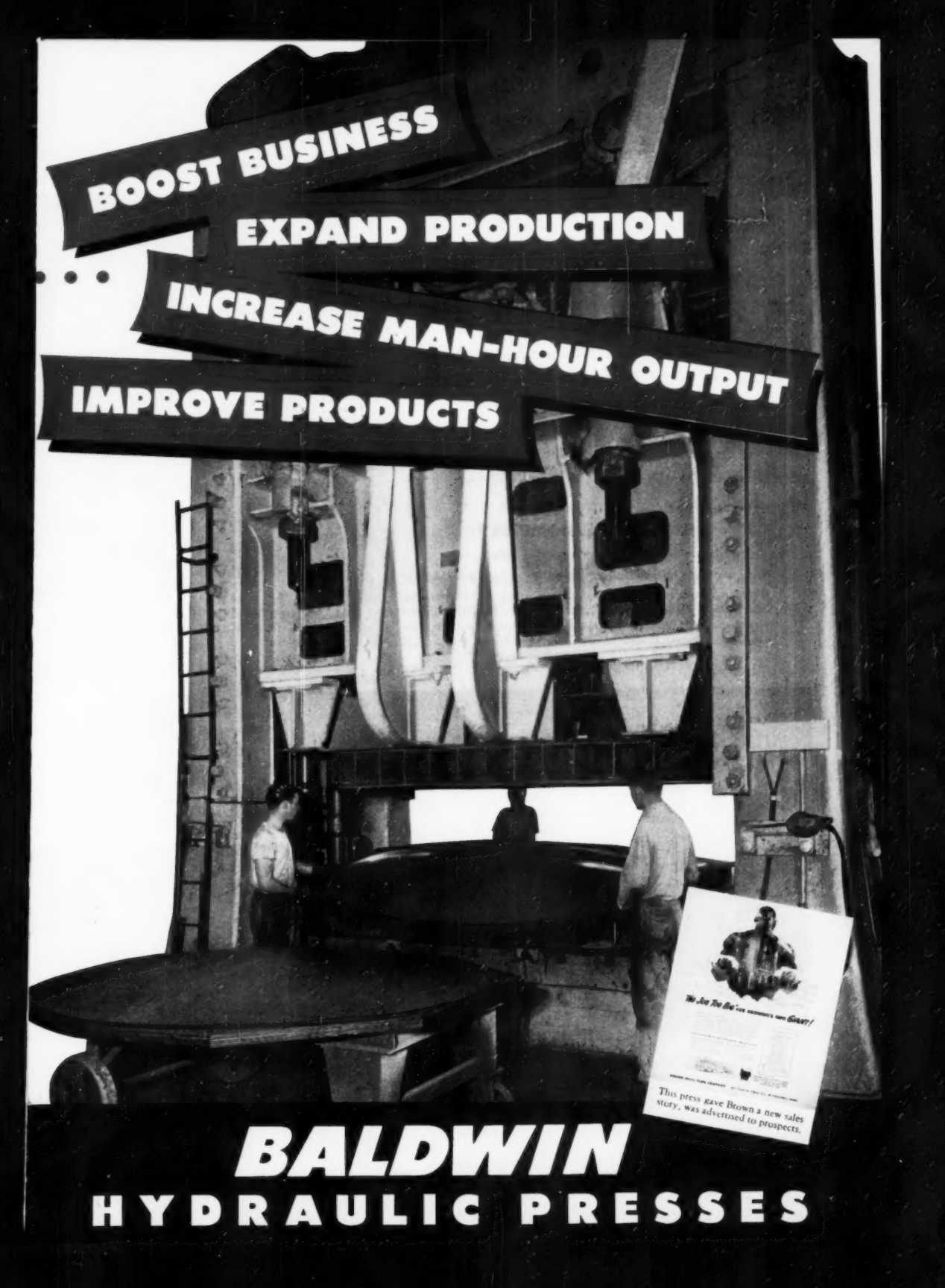
Baldwin experience includes production of all sizes and types of presses, for both jobbing and highly specialized operations. You'll find this know-how a big help in *defining* your exact press requirements—and *designing* a unit to meet them. For a quick picture of what Baldwin has to offer, ask for Bulletin 285.

The press extends 26′-8½″ above the floor, and 19′-10½″ below it. Bed dimensions are 84″ x 133″. Plunger stroke is 37″. Shut height of press 72″. Cushion stroke 12″. Drawing capacity depth 13″ to 22″. Inner slide capacity 600 tons; outer slide, 300 tons; lower action, 600 tons. It offers the custom-built advantages that have made Baldwin presses outstanding producers in the metal forming field: complete operator control of the slide during every portion of the working and return stroke, easy die interchange, full pressure availability regardless of stroke used, small number of working parts, and rugged design that minimizes maintenance.

Brownie city delivery trailer with 4000 gallon four-compartment tank.

BLW THE BALDWIN GROUP

The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A.
Offices: Boston, Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco Seattle, St. Louis, Washington. In Canada: Baldwin Locomotive Works of Canada, Ltd., Toronto, Ontario.


BOOST BUSINESS
EXPAND PRODUCTION
. . .
INCREASE MAN-HOUR OUTPUT
IMPROVE PRODUCTS
This press gave Brown a new sales story, was advertised to prospects.
BALDWIN
HYDRAULIC PRESSES

Murray Corporation of America!

Selection of the right press for the specific job is made only after careful study and recommendations by the Bliss engineering staff, according to Murray's pressroom superintendent. It is this ever-expanding fund of knowledge, over 90 years in the making, that has made Bliss the first choice of stampers the world over. "Ranking next in importance," he says, "is Bliss' prompt service when parts have to be replaced or the presses serviced."

It's another reason why the pressed-metal industry knows that Bliss on a Press Is More Than a Name—*It's a Guarantee!*...why it pays *you* to put your press problem up to Bliss.

E. W. BLISS COMPANY

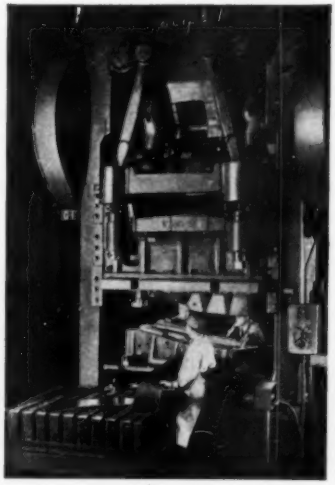
General Offices: Toledo 7, Ohio

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

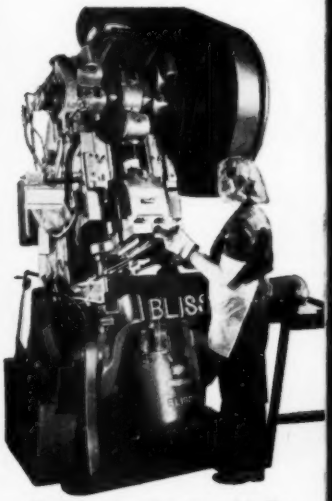
WORKS AT: Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Derby, England; St. Ouen sur Seine, France. SALES OFFICES AT: Detroit, Mich.; New York, Rochester, N. Y.; Cleveland, Toledo, Salem, Ohio; Philadelphia, Pittsburgh, Pa.; Chicago, Ill.; New Haven, Conn.; Windsor, Ont.

Trimming the turret top in a 4-point enclosed single action press with 160" wide bed. Press has 650 tons capacity. Operation is by electric push-button.

A Bliss adjustable bed press of 40 tons capacity is shown being used for general punch press work.



Deep pillars are drawn in Bliss No. 795½ Toggle Press. "The finest drawing press on the market," according to the pressroom superintendent.



Blanking salvaged scrap steel in No. 21½ Inclinable Press. Die cushion in bed permits shallow drawing.

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY IN THE WORLD

BLISS BUILT

325 BLISS-Built Presses at The

Turret top completely formed with one stroke of Bliss enclosed toggle press after being removed from die.

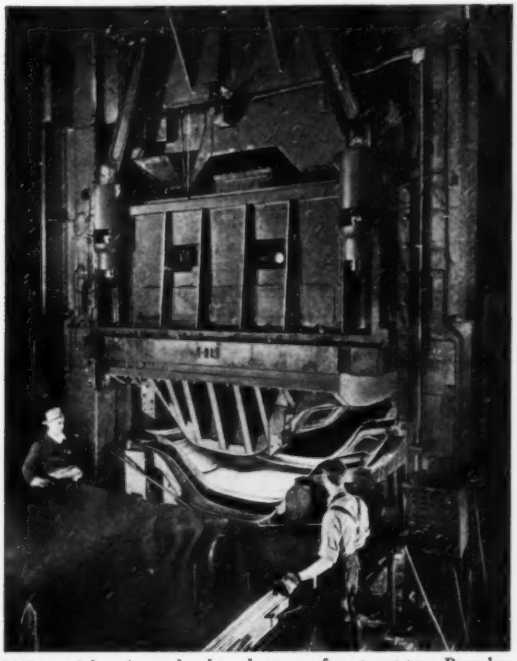
Counsel on right press for job and prompt service are big factors

IT'S A FACT! Over 325 Bliss presses of all types and sizes fabricate a diversified line of steel products in the plants of the Murray Corporation of America, one of the largest producers of automotive parts and home appliances.

Fully 75% of the presses in Murray's Detroit plant alone are Bliss-Built! They range from the 40-ton Bliss inclinable press shown blanking parts for a home-appliance unit to the 1400-ton triple-action toggle press which forms turret tops of low, medium and high priced cars.

Some of the ways Bliss presses are kept busy in this plant are illustrated in the accompanying photos.

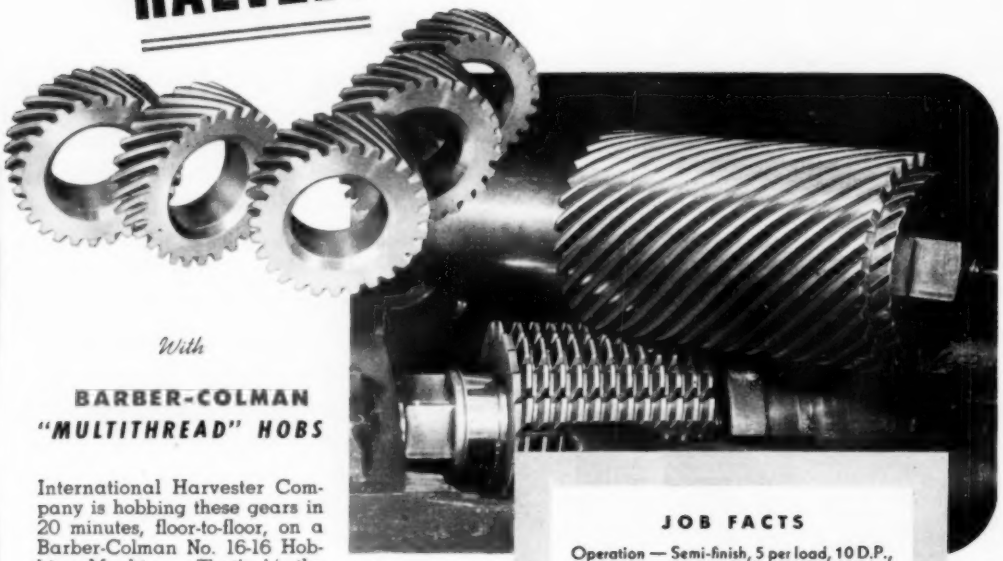
Two of a battery of 13 Bliss straight-side double-crank presses are shown forming pillars.



1400-ton triple-action enclosed toggle presses form turret tops. Press has four points of pressure on blankholder slide; is made of stress-relieved steel.

HOBBING TIME HALVED!

AT INTERNATIONAL HARVESTER



With

BARBER-COLMAN "MULTITHREAD" HOBS

International Harvester Company is hobbing these gears in 20 minutes, floor-to-floor, on a Barber-Colman No. 16-16 Hobbing Machine. That's ½ the time required before using Barber-Colman *"Multithread"* hobs. Tool life is 200 gears per sharpening. Involute is held within .0008", and spacing within .0003" tooth-to-tooth and .0008" total index.

More threads, more production! That's the simple theory on which these hobs work. Double the number of threads, and you double the speed of indexing. The overall production increase varies for each job (some jobs, of course, are not adaptable to *"Multithreads"*).

This is only one of many actual cases where *"Multithread"* hobs have worked production magic. A Barber-Colman Hob Engineer will be glad to discuss the possibilities with you.

JOB FACTS

Operation — Semi-finish, 5 per load, 10 D.P., 3.696" O.D., 27 T., 6¼" cut.
Material — SAE 1137 steel
Hobs — B-C Double Thread 4" x 4" x taper bore
Fl-to-Fl — 20 minutes per load
Feed — .051"/rev. Speed — 139 RPM
Tool Life — 200 pieces per sharpening

Barber-Colman Company

GENERAL OFFICES AND PLANT, 3121 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

MORE FACTS

Case histories contain production records on 100 Hobbing Jobs. Your copy sent free on request. Ask for File No. 3121.

THE GREENFIELD STORY

"Acorn"

THE coming of mass production called for a new type of die which could be operated at high speed on machines. *The "Acorn" Die has proved to be the answer.*

The "Acorn" Die is simple in design. Shaped like an acorn, it is held in holders which fit any machine. A screw cap gives quick, accurate adjustment. The "Acorn" Die is today, as it has been since 1909, the most popular production die on the market. Through the years, "Greenfield" threading engineers have added several refinements of design, but the principle is still the same — a tool that has made a major contribution on production lines in war and in peace.

The complete story of the "Acorn" Die is yours for the asking. Just ask your local "Greenfield" Distributor, or write direct.

GREENFIELD TAP and DIE CORPORATION
Greenfield, Massachusetts

and

THE GEOMETRIC TOOL CO.
New Haven 15, Connecticut

and

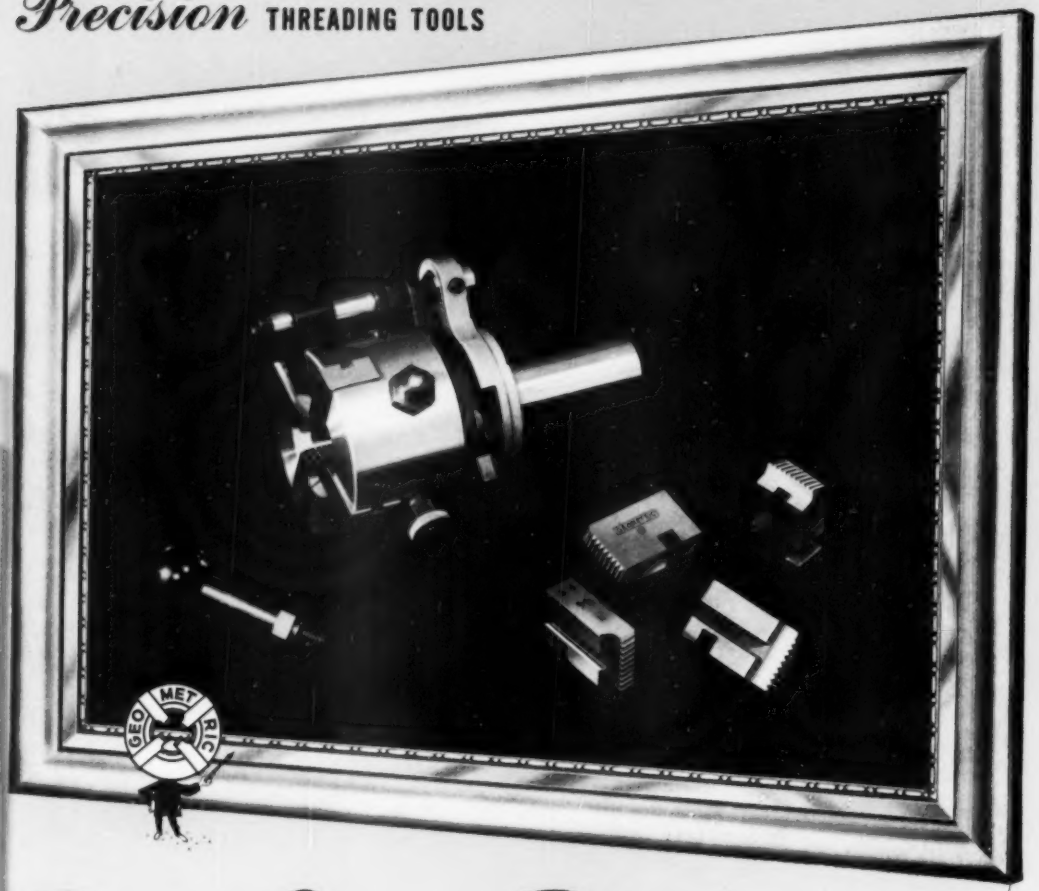
AMPCO TWIST DRILL CORP.
Jackson, Michigan

Divisions of Greenfield Tap and Die Corporation

GTD
GREENFIELD

Be Sure
Buy "Greenfield"

Precision THREADING TOOLS



New Aligning Shank

Style DS Die Head and Chasers

Quick adjustment to compensate for misalignment when threading . . . an optional feature that has been added to the Convertible DS Die Head.

★ ★

Available in 5/16", 9/16" and 3/4" sizes.

★ ★

GEOMETRIC also makes a complete line of Rotary and Stationary Self Opening . . . and Solid Adjustable Die Heads—Collapsing . . . and Solid Adjustable Taps—and GEOMETRIC Chasers.

"Be Sure . . . Buy Geometric"

THE

GEOMETRIC

TOOL COMPANY, NEW HAVEN 15, CONNECTICUT

GTD

GTD AMPCO

AUTO-LITE *announces...*

Tune in "Suspense!"—CBS Radio Network Thursdays, CBS Television Tuesdays.

The new Auto-Lite plant at Lockland, Ohio, one of the largest manufacturing plants in the world, devotes a part of its 3,500,000 square feet of floor space to precision die casting.

Increased production facilities for

DIE CASTINGS

● **Here is important news for everyone who has need of the accurate, reliable die castings made possible with the famous Auto-Lite "controlled metals" processes. The opening of the great new Lockland plant of Auto-Lite, combined with the enlarged facilities at Woodstock, Illinois, greatly increases Auto-Lite's ability to furnish the high quality die castings for which the Auto-Lite name is known wherever die castings are used. We invite your inquiries.**

THE ELECTRIC AUTO-LITE COMPANY
Die Casting Division, Woodstock, Illinois

600 S. Michigan Avenue
Chicago 5, Illinois

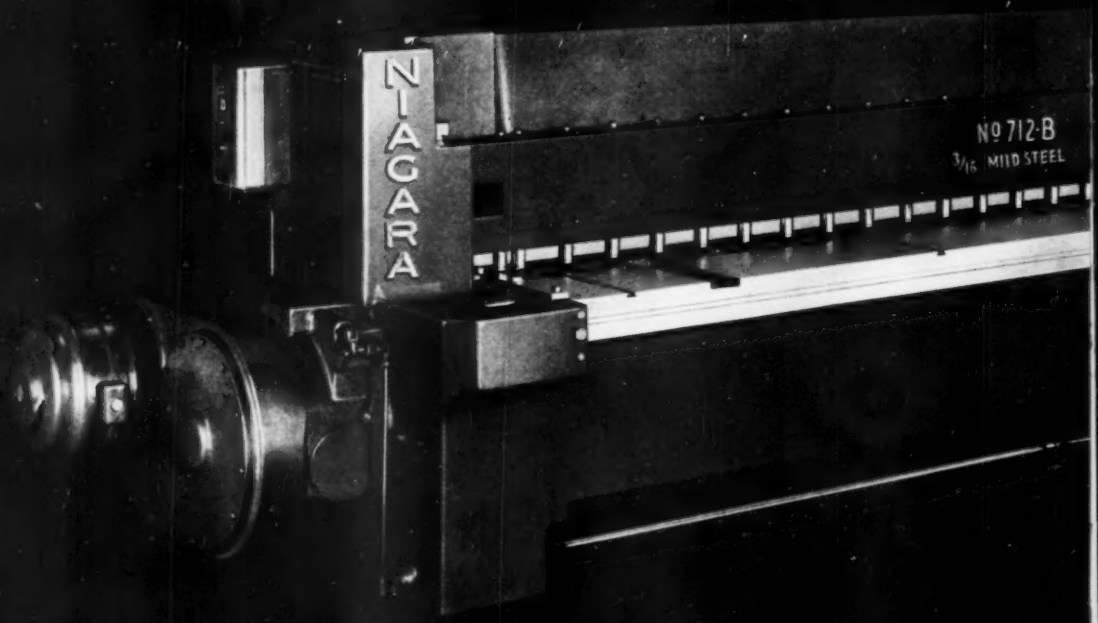
723 New Center Bldg.
Detroit 2, Michigan

AUTO-LITE MEANS PRECISION MANUFACTURING

70 YEARS *of*

TALENT *and* EXPERIENCE

Behind the DEVELOPMENT *of*



NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

NIAGARA

America's Most Complete Line of

PRESSES
SHEARS
MACHINES
and **TOOLS**
for Plate and
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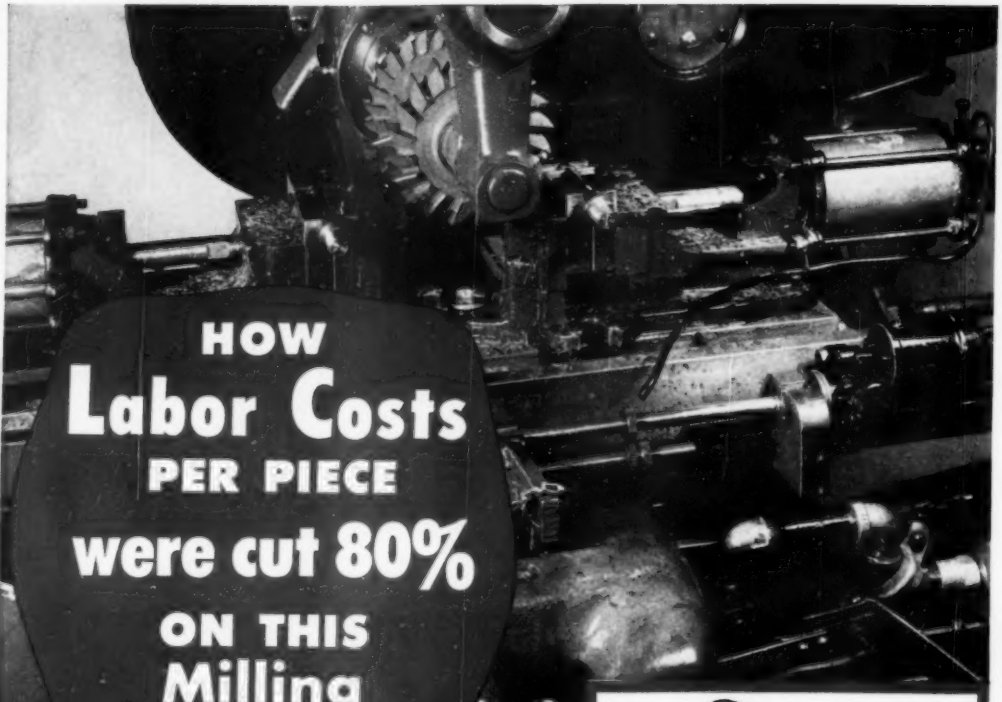
DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK



HOW Labor Costs PER PIECE were cut 80% ON THIS Milling Operation

THE cost of milling an anchor pin in this midwestern plant was running too high. The part was hand clamped and hand milled—one end at a time on a standard hand milling machine.

A Bellows Field Engineer suggested that the operation could be made simple and inexpensive with Bellows "Controlled-Air-Power" Devices.

A continuous action Bellows Air Motor was installed to traverse the table. Two Bellows Hydro-Checks served to control the table movement, assuring positive smoothness of feed and eliminating any back lash or chatter.

Bellows Air Vises were mounted on both ends of the table and were linked to the bed to open and close automatically. As the unit now operates the operator loads one vise while the other is under the cutter. Once the unit is started all operations except loading and unloading are continuous and automatic.

The result: *Labor costs per piece were cut 80%; production jumped from 75 pieces per hour to over 400; cutter life was increased 600%.*

Such cost saving experiences are not unusual in plants using Bellows "Controlled-Air-Power" Devices. In fact, our case history files are filled with stories of cost savings accomplished with "Controlled-Air-Power". We'd like to send you our latest Foto Facts File Series. It's filled with ideas that can help you save money. No cost or obligation. Write: The Bellows Co., Dept. AM 549, Akron 9, Ohio.

The Bellows Co.
AKRON, OHIO

How to give higher quality to your products

Here's how a company, manufacturing multiple-spindle drilling equipment, obtained even higher quality for its products. The same plan will work for you.

This concern, Seibert & Sons, Inc., East Peoria, Illinois, always keeps eyes peeled for ways to make its products the best possible.

That's why a Standard Oil Cutting Oil Engineer was asked to make a survey of plant operations. The adoption of his recommendations led to these results:

Greater accuracy was obtained on machined parts when automatic and turret lathe operations were shifted to Stanicut 155 CS Cutting Oil. Operators now easily maintain a tolerance of plus or minus .0025 of an inch from the mean dimension.

On the grinding jobs, a switch to Superla Soluble Oil produced finer finishes on the spindles. Finishes now measure between 6 and 8 microinches.

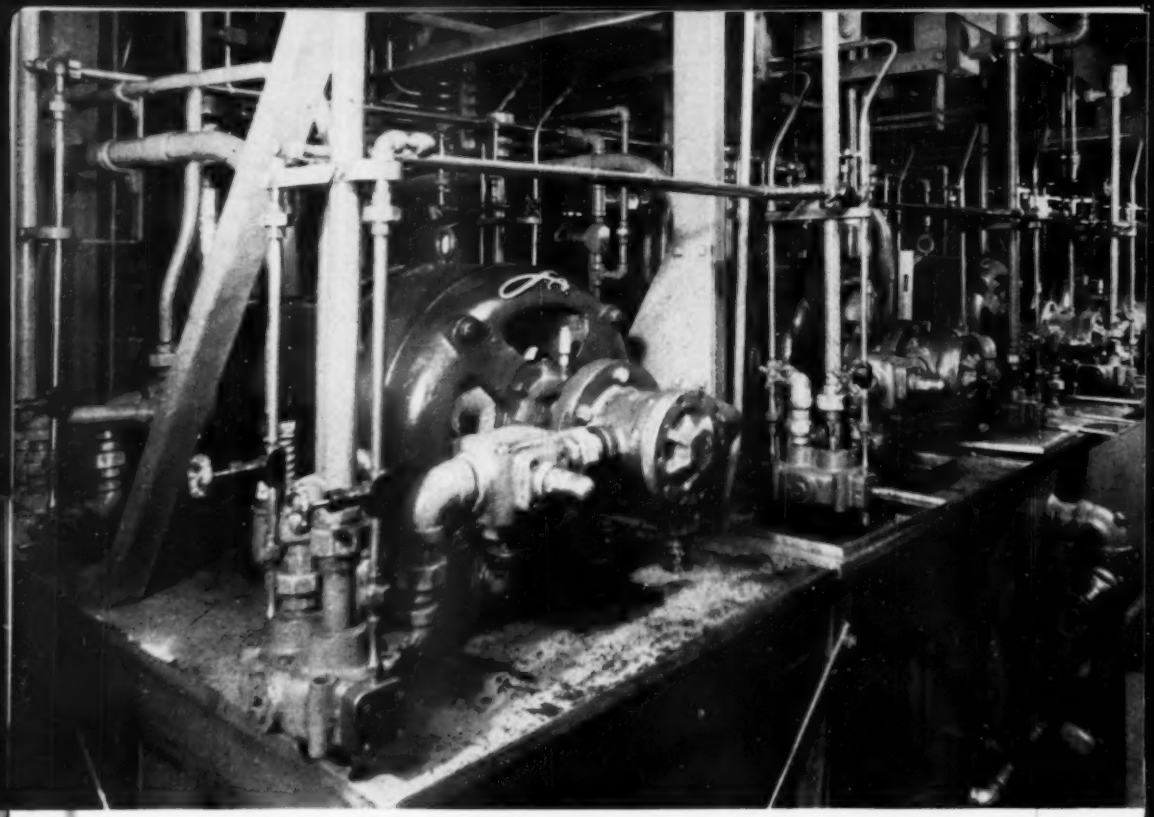
The Engineer's survey that resulted in these product improvements also led to other benefits. The number of lubricants used throughout the plant was sharply reduced. Moreover, Seibert & Sons report that Standard Oil's more versatile products boosted production and reduced machine downtime.

Standard's CUTTING OIL SERVICE

Why not take advantage of Standard Oil's Cutting Oil Service? This combination of expert engineering service and highest quality products can make important savings for you.

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD



How to boost the efficiency of your hydraulics

STANOIL
Industrial Oil

A 3,000-gallon central hydraulic system, shown in part above, is used for the operation of 55 molding presses in a midwest manufacturing plant. In 1942, Stanoil 18 was introduced into this large system.

Tests of oil samples, made every six months, showed practically no deterioration of Stanoil. When the oil was changed, after more than 3 years' service, it showed a neutralization number of only 0.53. In the entire 6½ years of operation, make-up oil averaged no more than a barrel per month and there were no deposit or corrosion troubles.

These facts indicate the benefits you can gain by switching your hydraulics to Stanoil, but they by no means tell the full story. This unique, multi-purpose oil will provide clean, dependable lubrication in a wide variety of circulating systems. You can replace costly special oils and simplify stocking problems by using Stanoil throughout your plant. A Standard Oil Lubrication Engineer will be glad to help you.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD

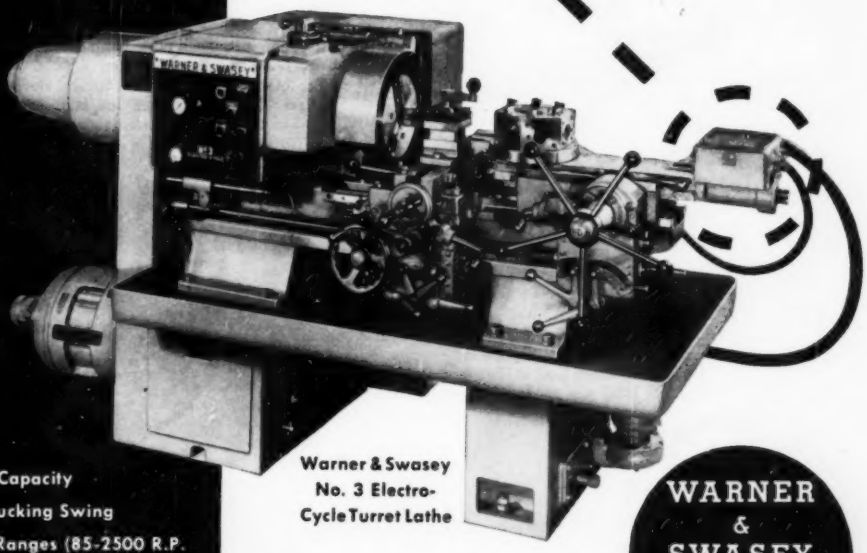
New *Electro-Cycle* TRADE MARK control for faster, easier turning of all metals

MACHINE HANDLING TIME and operator fatigue are problems in your production . . . and the Warner & Swasey No. 3 Electro-Cycle Turret Lathe is a natural solution. Most time-taking and tiring manual operations are eliminated for the operator when the Electro-Cycle control takes over.

This automatic control directs the functioning of the spindle for each hex face. Spindle start, direction of rotation, speed changes, reversal and stop, and positioning for ease in loading are all automatically controlled. Setting the control takes but a few seconds.

The Electro-Cycle principle has been used profitably for some time in the brass shops. Now it is available in the new No. 3 Electro-Cycle Turret Lathe to serve *all* of your long and medium run production needs on *all* metals.

After studying your jobs, the nearest Warner & Swasey field representative can tell you where the Electro-Cycle fits into your operation. Call him now, or write . . .



Warner & Swasey No. 3 Electro-Cycle Turret Lathe

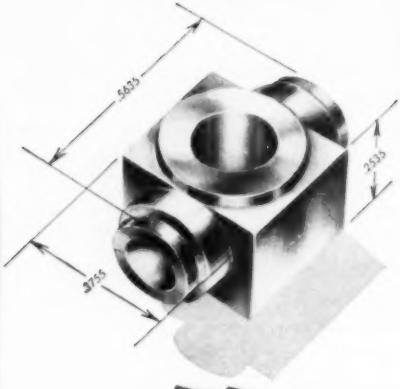
- 1½" Bar Capacity
- 15⅜" Chucking Swing
- 5 Speed Ranges (85-2500 R.P.M.) available during setup
- 4 Speeds automatically available during operation

You can machine it better, faster, for less...with a Warner & Swasey

WARNER & SWASEY Machine Tools *Cleveland*

TURRET LATHES, MULTIPLE AND SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

IF YOU USE STAINLESS STEEL

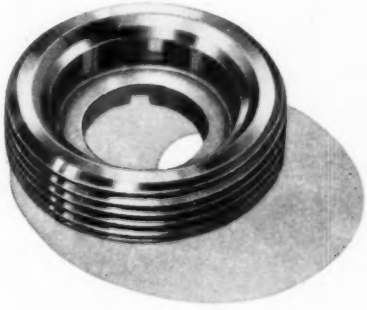


TRIED MANY KINDS OF TYPE 416 STAINLESS

Tolerance of ± .0001" specified on this precision part, and the Factory Manager says: "Experience with other materials shows that we have *considerably less rejections, better machining time and less trouble* when we use Carpenter Stainless No. 5".

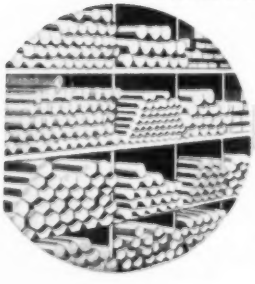
UNIT PRODUCTION UP 15% ON THIS JOB

These small instrument parts are machined to close tolerances: ± .0002" on the diameter, ± .0005" on the length and ± .0003" on concentricity. Several kinds of Type 303 Stainless were used, but unit production per shift went up 15% when the change was made to Carpenter Stainless No. 8 (Type 303).



REJECTS DOWN 40%

Tool life more than doubled and each bearing race cost only 5¢ to produce when they changed to Carpenter Stainless No. 8 (Type 303). Before the change, rejects were excessive and costs were so high that the company wanted to get rid of the job.



Now add to the advantages of *Carpenter* Free-Machining Stainless

Rush **DELIVERY FROM YOUR NEAREST WAREHOUSE—**

BOSTON	CINCINNATI	HARTFORD	PHILADELPHIA
BRIDGEPORT, CONN.	CLEVELAND	INDIANAPOLIS	PROVIDENCE
BUFFALO	DAYTON	LOS ANGELES	ST. LOUIS
CHICAGO	DETROIT	NEW YORK	WORCESTER, MASS.

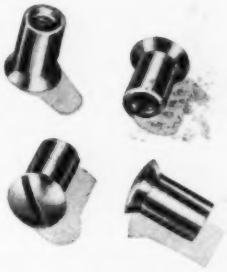
SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

here are the results you can get by changing to *Carpenter* Stainless . . .

If you are hard to convince—if you believe that all Stainless Steels of the same Type Number are alike, look at the jobs shown here.

Each of these jobs was first done with the same type Stainless from another source, but look at the savings when the change was made to Carpenter *Free-Machining Stainless.*

The reason for savings like these is uniform free-machining properties in bar after bar of Carpenter Stainless, no matter when you buy it. If you want proof that you can cut costs on Stainless machining jobs, send your next production order to your nearest Carpenter warehouse listed below.



REJECTS CUT BY ½

You can't afford many rejects on mass production low cost jobs. When this change was made to Carpenter Stainless No. 5 (Type 416), rejects were cut in half and tool life increased 25%.

23,400 BONUS PARTS

Longer tool life, less machine down-time, accounts for 23,400 extra parts per run—*and the company saves $456.00 per year on tool regrinding* now that Carpenter Stainless No. 8 (Type 303) is used.

Stainless Machining "Know-How" Is a Help on Every Job . . .

Useful machining information collected in our work with users of Stainless has been put into the 96-page Carpenter "Notebook on Machining Stainless Steels". For your copy, send us a note on your company letterhead, indicating your title. For the men in your plant, additional NOTEBOOKS are available at 50¢ apiece.

THE CARPENTER STEEL COMPANY, 109 West Bern Street, Reading, Pa.

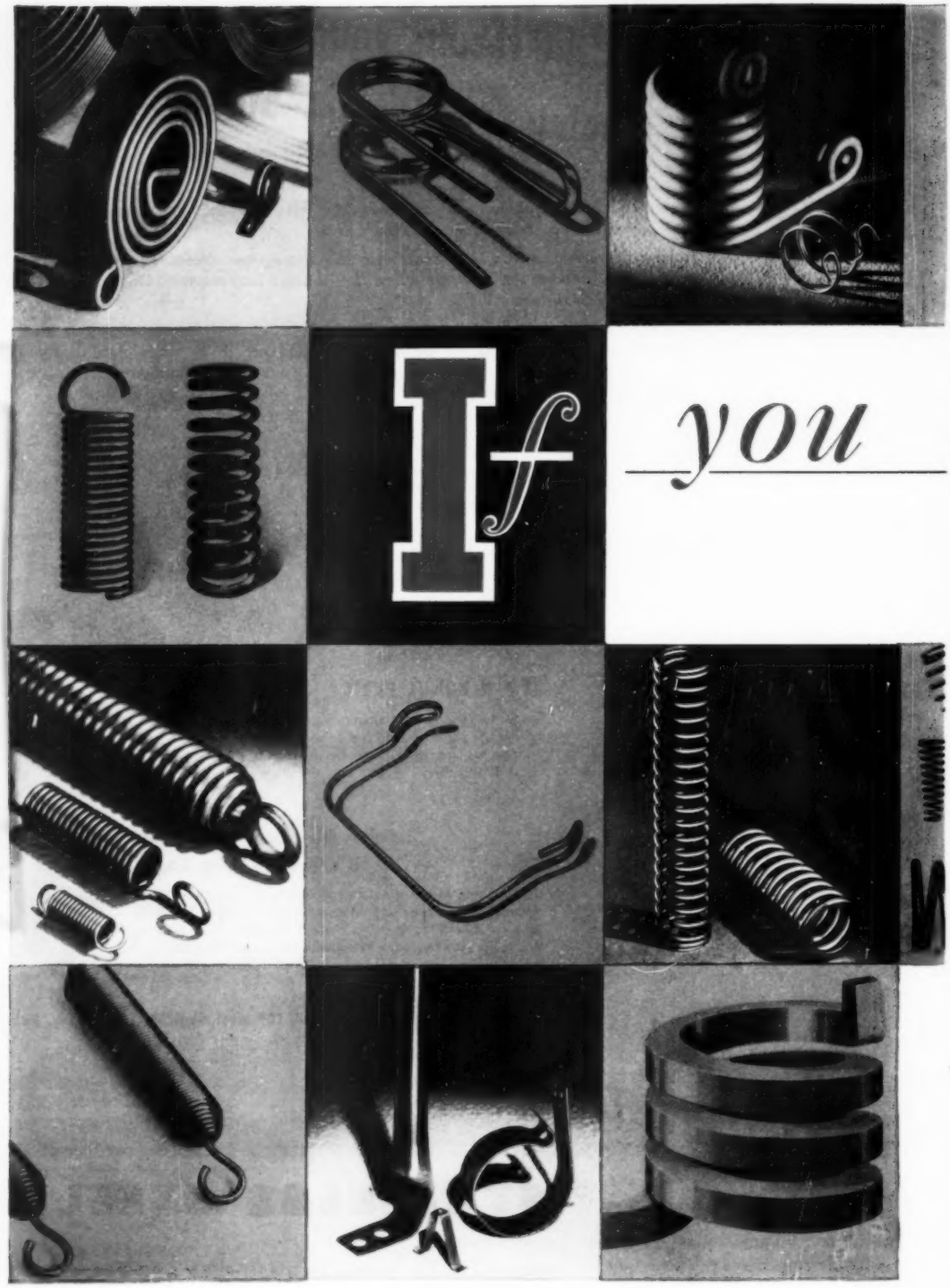
Carpenter

more than corrosion resistance

FREE-MACHINING

STAINLESS STEELS

Export Department: 233 Broadway, New York 7, N.Y. "CARSTEELCO"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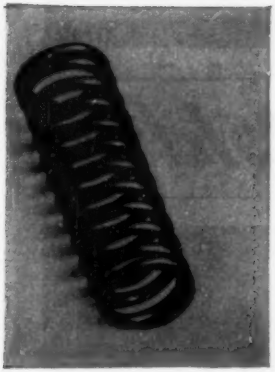
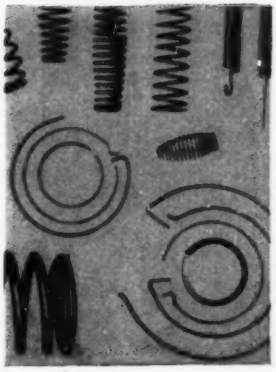


use springs

...then this is for you!



● There is only one place where spring performance can be judged accurately. In service! That's where your choice of spring material spells the difference between bristly tempers and customer satisfaction.

While we can't advise you on the way to handle the *complaints* about spring failures, we believe we can give you some sound advice on how to *minimize* failures. And that is—*install American Quality Springs.*

In automobiles . . . farm equipment . . . alarm clocks . . . phonographs . . . typewriters . . . window shades and hundreds of other products, American Quality Springs have done an outstanding job. They have withstood extreme temperature changes. They've given years of faithful service under high stresses. They've been subjected to severe corrosive conditions and have come through with flying colors. And they've given admirable performance in applications where exceptionally close tolerance precision and unfailing uniformity were imperative.

In helping you work out your spring problem we offer the services of highly-trained spring engineers who keep in touch intimately with the latest metallurgical developments. And we place at your disposal production and testing facilities that are generally regarded as the finest in the country. Contact our nearest office or 408 Rockefeller Building, Cleveland 13, Ohio.

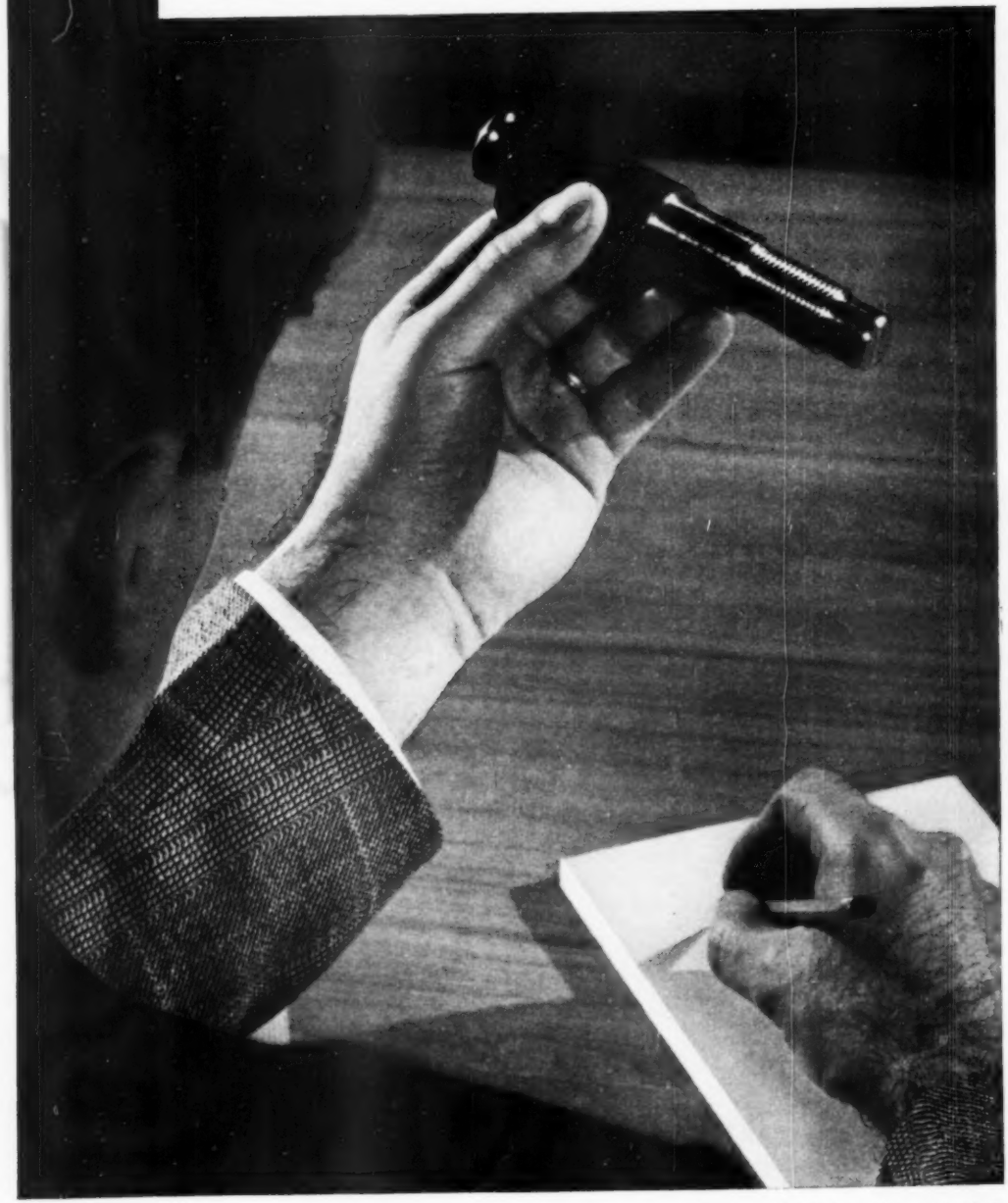
AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

AMERICAN QUALITY SPRINGS

UNITED STATES STEEL

When you're told to



"Sharpen your Pencil"...

—you'll need this improved

MACHINABILITY

. . . because the MACHINABILITY of the steel bars you use, probably more than any other single factor, can help you whittle steel parts costs down to lowest obtainable levels. This is particularly true in parts where the cost of machining approaches the cost of the steel used.

Recognizing the vital importance of MACHINABILITY, Union Drawn Metallurgists and Engineers have spent many years in laboratory, mill and customers' plants studying the intricacies of this important factor. They have acquired an unequalled knowledge of MACHINABILITY, which through constant application in the production of Union Cold Drawn Steels now brings you:

1. Top ratings on speeds and feeds
2. Uniformity of Machinability—bar after bar
3. Smooth, bright machined surfaces
4. Freedom from abrasive elements
5. Longer tool life—fewer grindings
6. Higher production efficiency
7. Increased output
8. Lower unit production costs

Union Drawn Metallurgists are well qualified to help you "sharpen your pencil" on costs. They can show you how to use Republic Union Drawn Bessemer, carbon, alloy and stainless steels to best advantage—quality-wise as well as cost-wise. Through Union Drawn's complete facilities for furnace treatment—annealing, normalizing, stress-relieving and spheroidizing—they may be able to help you effect even greater economies. Write for further details.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • • • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic

REPUBLIC STEEL — REG. U.S. PAT. OFF.

DS

UNION COLD DRAWN STEELS

Free-Machining Bessemer, Alloy and Enduro Stainless Steels
•
Union Cold Drawn Special Sections
•
Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting.)

Announcing

the NEW DANLY

HEAVIER CONSTRUCTION FOR

Danly Heavy-Duty *Autofeed* Presses are performance-engineered for faster, automatic stamping of parts. Now, the most complete line in the field, these presses offer the cost-saving advantages of coil-fed operations through a wider range of capacities.

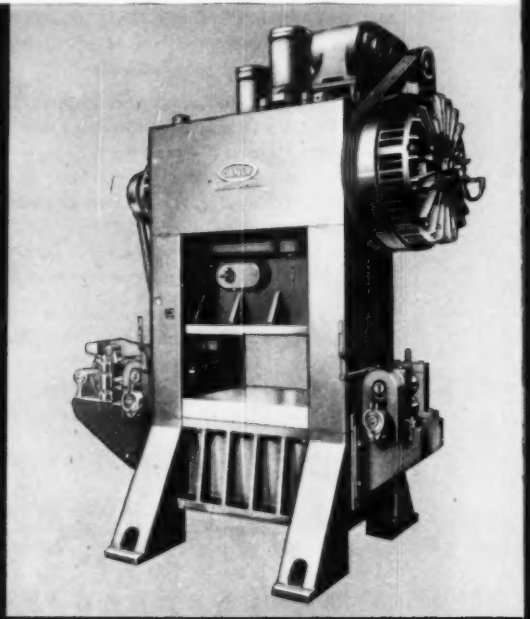
Heavy-Duty *Autofeed* Presses are of extra heavy construction. The frame, slide, clutch, and drive units are of much heavier design for the rated capacity of the press. Consequently, deflection and vibration is substantially reduced at higher operating speeds. Stamping accuracy is improved, and die life is increased, permitting longer production runs between grinds.

Highly versatile, Danly *Autofeed* Presses meet the all-around needs of the average production stamping shop. They are especially designed for ease of die changing and die setting, and low maintenance costs—today's best answer for more profitable stamping operations.

FLOATING FRICTION DISC CLUTCH REDUCES MAINTENANCE

Other cost-saving features of Danly *Autofeed* Presses include an exclusive air-cooled, air-operated clutch. Used on all Danly presses, this clutch has withstood millions of engagements under test without perceptible wear. Low clutching inertia reduces heat and wear, yet flywheel energy is actually greater. There is less maintenance and fewer production interruptions.

Built-in automatic lubrication, two-point oversize slide connections, and Danly proof-tested electrical controls are likewise performance-engineered features that help promote more efficient, safer press operations.



DANLY SERIES HA 50 TO 150-TON
NON-GEARED ECCENTRIC SHAFT DRIVE
SPEEDS: 75-300 S.P.M. STROKES: 1-4 INCHES

DANLY

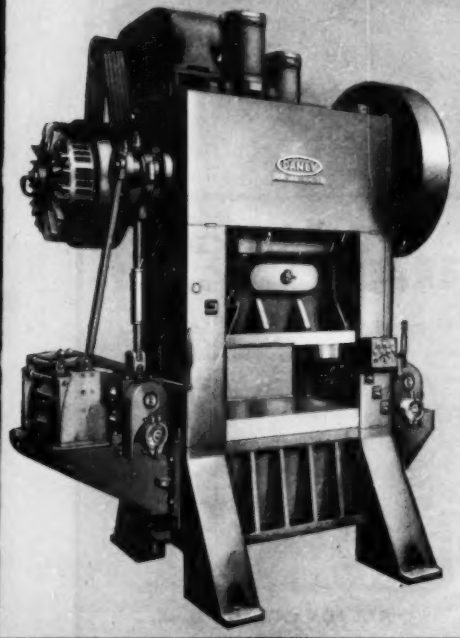
MECHANICAL PRESSES

COMPLETE LINE OF *Autofeed* PRESSES

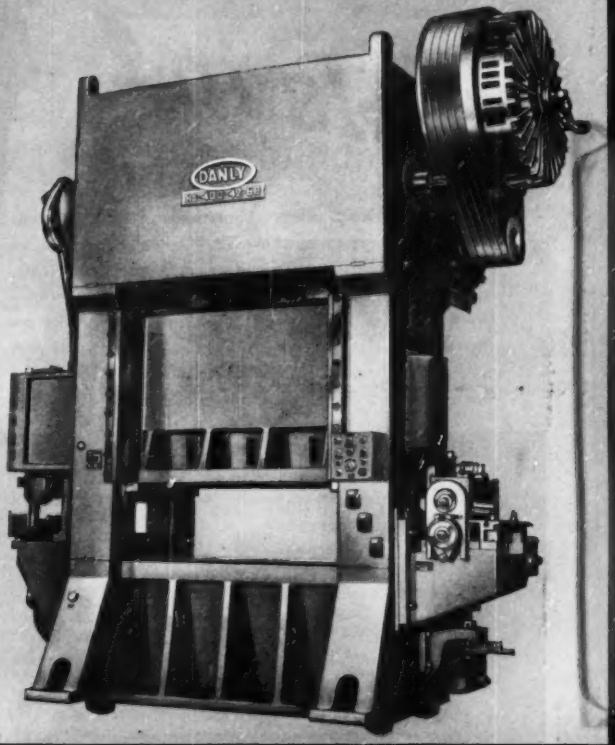
RATED CAPACITY .. SIZES FROM 50 TO 800 TONS

WRITE FOR NEW CATALOG

Learn more about these modern presses. Write for the new Danly *Autofeed* Press Catalog. It includes complete specifications, description of operating features, and details of stock handling equipment.



DANLY SERIES HA 50 TO 150-TON
GEARED ECCENTRIC SHAFT DRIVE
SPEEDS: 40-150 S.P.M. STROKES: 3-7 INCHES



DANLY SERIES HA 200 TO 800-TON
ECCENTRIC GEAR DRIVE
SPEEDS: 20-80 S.P.M. STROKES: 4-8 INCHES

STANDARD *Autofeed* LINE OF PRESSES

In addition to the Danly Heavy-Duty *Autofeed* Presses, there is a complete Standard *Autofeed* Line of presses available from 50 to 150-ton capacities. The standard line is built with the same high precision and also has the same exclusive Danly mechanical features as the extra-massive Heavy-Duty *Autofeed* presses.

DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52ND AVENUE • CHICAGO 50, ILLINOIS

AND PRESS EQUIPMENT

OVER 25 YEARS OF DEPENDABLE
SERVICE TO THE STAMPING INDUSTRY

VERS-O-TOOL

4 tools in 1

No other die-head offers as much—and with as great economy of investment. One Vers-O-Tool head handles *all* requirements for threading and hollow milling, within a given diameter range, on both large lots and small. Standardization of interchangeable chasers reduces tool inventory to a minimum—yet precision performance is instantly available for every job, at a lower per piece cost than for any other comparable method.

ONE MICRO-GAGE CHECKS ALL 4

giving positive indication of the amount of chaser grind and insuring uniformity of regrind. Replacement of Chasers in head takes less than one minute.

VERS-O-TOOL

Circular and Adjustable Blade Chasers

with their respective blocks and holders

ARE INTERCHANGEABLE

size for size in three standard styles of heads:

STYLE DR
Revolving Type—12 sizes—3/16"-4 7/8"

STYLE DS
Non-Revolving Type—8 sizes—3/8"-4 7/8"

STYLE DBS
Browne & Sharpe Type—2 sizes—3/8"-9/16"

ASK FOR CATALOG D-48.

24 hour deliveries on standard stockable NF and NC Chasers and Blocks.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

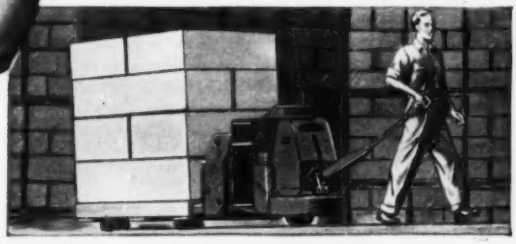
Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

AMAZING AUTOMATIC ELECTRIC TRUCK CUTS HANDLING COSTS IN HALF

WORKS FULL 8-HOUR DAY FOR 11c!*

Moves and stacks tons of products with push-button ease

Lasts Many, Many Trouble-Free Years!



SAVES USERS THOUSANDS OF DOLLARS

IMAGINE an electric truck that works a full 8-hour day for as little as *11c a day battery charging cost . . . and cuts your handling costs in half . . . savings amounting to thousands of dollars, depending on the tonnage you move in your plant.

That's what amazing Automatic Transporter will do for you . . . lift and move 2,000, 4,000 and 6,000 pound loads with feather-touch of thumb on electric control buttons.

Note its effortless operation in the picture above. Could anything be easier, more efficient, time saving? And how it "lightens labor's load." Muscle Mike, the brawny midget of electrical power in its motor does all the work. One man does more with less effort than three hand truckers, releasing labor for more productive work.

Transporter's bigger sister, the new Tilting Type Transtacker, also STACKS your product . . . gives you faster, safer load spotting and cradling . . . with a single lift of 64 inches and a telescopic lift of 120 inches.

Here's an extra bonus of free storage space to heights manual handling couldn't touch. See the picture to the left . . . *picture* the dollars saved it will bank for you. Works long, steady on same battery as Transporter . . . operating cost is fantastically low.

Transtractor, shown lower left, will push or pull 6000 pounds all day long or up to 20,000 pounds intermittently. Again, finger-tip control, low cost Transporter battery operation.

Either one, or all of these Transtriplet miracle electric trucks will do a material handling job that will total up to savings that will astound you . . . with operating cost a minor factor. Let us tell you, and show you more in our free material handling catalog. Mail coupon.

Transporter
A PRODUCT OF AUTOMATIC
Lightens LIKE'S LOADS

AUTOMATIC TRANSPORTATION CO.
DIV. OF THE YALE & TOWNE MFG. CO.
59 West 87th Street, Dept. E-9, Chicago 20, Ill.

Send me complete facts and FREE catalog describing fully ( ) Transporter ( ) Transtacker ( ) Transtractor, and the material handling savings they can bring my business.

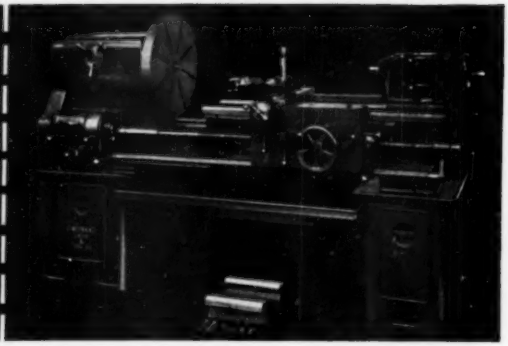
Company Name .....

By .....

Street Address .....

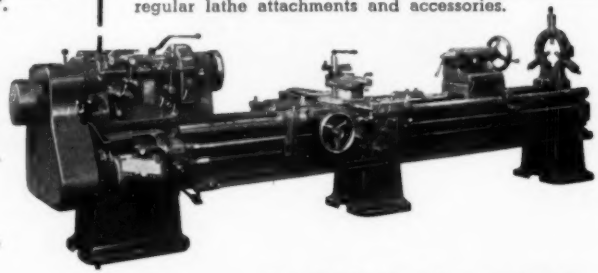
City ..... *Zone* ..... *State* .....

GET MORE... PAY LESS

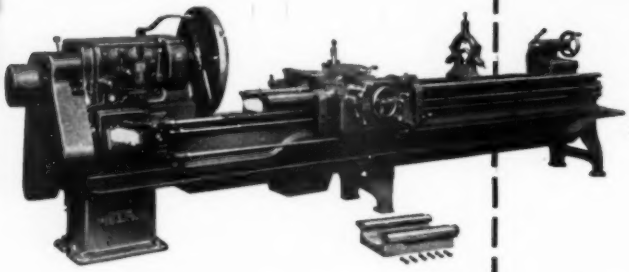


Lightweight Champ: The new Tray-Top line of light duty geared head engine lathes (10", 12⅛", 15", and 18" swing sizes) offers many "high price" lathe features at truly low cost: 12 spindle speeds, selected by color-coded dial, 48 thread and feed changes, exceptionally large spindles, anti-friction bearings, double-walled apron, totally enclosed quick change gear box, many others. Distance between centers from 18" to 60".

All This – And Gap, Too: 15" and 18" Tray-Tops furnished with gap, give you 22" and 25" swings over gap. Carriage has short wings on headstock end for maximum approach of tool, wings on tailstock are extended for maximum rigidity and adequate bearing surface on bed. Like regular Tray-Top, distance between centers from 18" to 60", in increments of 6". All furnished with regular lathe attachments and accessories.



Middleweight Champ: In the medium duty class, the Standard line (14", 16", 18" 20", 22", and 24" nominal swings) assures you real all-around utility with exceptionally low initial investment, quickly pays for itself by efficient handling of practically all your turning, boring, and threading operations. 12 spindle speeds, 32 thread and feed changes, distance between centers from 30" to 240".



Gaps In All 6 Sizes – Increase Capacity: With swings over gap from 24½" to 38½", Standard Fixed Gap Bed Cintilathes give you oversize work capacity where cost of heavy lathe is not justified. Versatility and economy are balanced to your requirements.

WRITE FOR BULLETINS: *T-100 on Tray-Tops; T-101 on Tray-Tops with Gap; S-100 on Standards; S-101 on Standards with Gap.*

the best buy in its class

cintilathe

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO

SKIL Bench Grinder 447

The big, full-duty grinder with the "little grinder" price

More Features . . . More Quality . . . More Work Capacity

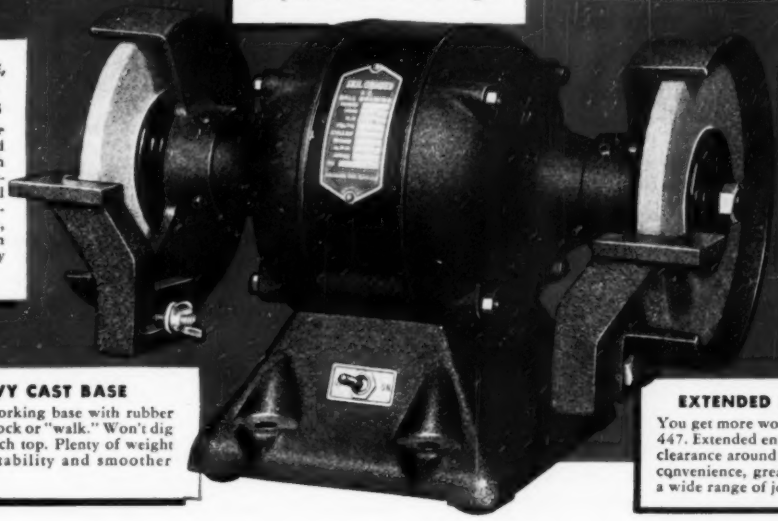
ONLY $39.50

FULL-SIZE 15" SPINDLE
A really full-size grinder—long 15 in. spindle—easier to grind on sides of wheel. Far better when used with wire brushes.

BIG, POWERFUL MOTOR
Quiet, vibration-free . . . ideal for sustained heavy duty service. Split phase, 50/60 cycle. Totally enclosed for protection from dirt and grit.

OVERSIZE, SEALED BALL BEARINGS
Extra big, ball bearings for smoother operation—longer life. Completely sealed for full protection against dust, dirt and grit.

ADJUSTABLE, MACHINED TOOL RESTS
Set-ups are simpler and faster with these easy-to-adjust tool rests. Machined, too, for precision work in any position.



REMOVABLE, CAST WHEEL GUARDS
Removable feature increases grinder uses. Guards are extra wide for use with wire brush wheels.

HEAVY CAST BASE
Big, solid working base with rubber feet. Won't rock or "walk." Won't dig in work bench top. Plenty of weight to insure stability and smoother operation.

EXTENDED END BELLS
You get more working room with 447. Extended end bells give extra clearance around wheels for more convenience, greater efficiency on a wide range of jobs.

Full-sized **SKIL Bench Grinder, Model 447, has plenty of weight and power. Sharpens, grinds, buffs or polishes. Extended end bell and wheel guard design provide extra work clearance that makes any job easier to do. So attractively priced you'll want to spot several Model 447's in convenient shop locations. Ask your SKIL Tools Distributor to demonstrate easy-to-own SKIL Bench Grinder, Model 447 today!**

SKIL TOOLS ARE MADE ONLY BY SKILSAW, INC.

SKIL ELECTRIC Tools PNEUMATIC
TRADE-MARK

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5033 Elston Ave., Chicago 30, Ill.
Factory Branches in Principal Cities
In Canada: SKILTOOLS, LTD., 66 Portland St., Toronto, Ont.

JOKER!

Bus builders are sticklers for saving weight. They put the bee on this seat manufacturer to make his product 25% lighter. "Why not switch to magnesium seat frames?" said his designer. "It has the right combination of lightness and strength." But he reneged . . . thought there was some kind of "joker" in magnesium fabrication. Just to make sure, he checked with Aluminum Company of America, light metal headquarters . . . and found that easy-to-follow shop practices make handling magnesium no problem.* He learned, too, that every month industry puts to work over a million pounds of magnesium.

He got technical help, plus valuable books on designing and fabricating magnesium. Now his new lightweight bus seats rate ace-high with his customers since he began using American Magnesium Castings and Extrusions for frames. It's his turn to put the bee on competition.

No change in insurance rates.

These two, free books on magnesium and our broad technical experience can help your products, too. Write Aluminum Company of America, sales agent for American Magnesium Products, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

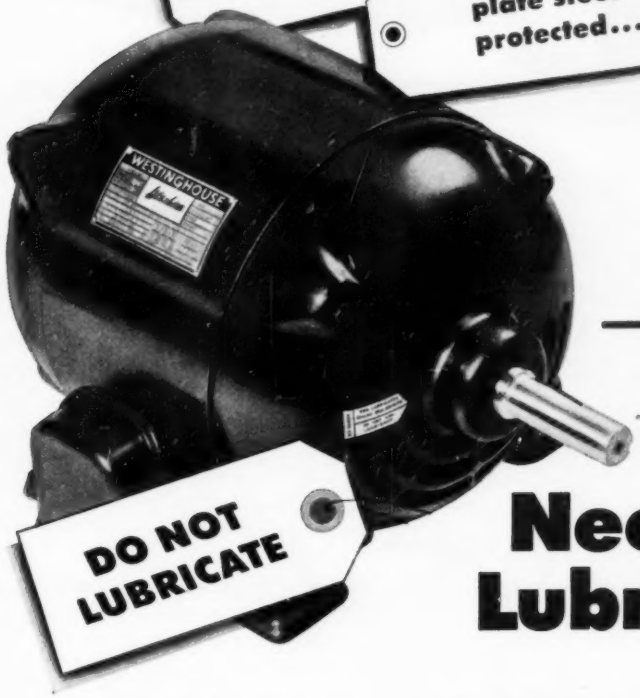
YOU CAN BE **SURE**.. IF IT'S

Westinghouse

◉ up to 1/3 less space...

◉ improved windings...

◉ plate steel protected...



—and NOW...

Needs No Lubrication

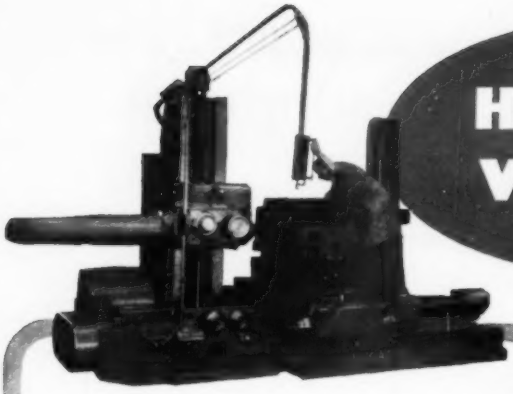
Now . . . for the first time . . . you can install electric motors, or motor-driven machines . . . and forget motor lubrication.

Westinghouse Life-Line . . . industry's amazing, new, all-steel motor . . . now completely eliminates need for lubrication. Life-Line motors are equipped with sealed bearings, pre-lubricated with a more-than-ample supply of specially treated lubricant. Correct lubrication is assured . . . machine outages are reduced . . . motor-drive problems are simplified, since motors can be located without need for constant accessibility.

Added to Life-Line's plate-steel protection, improved windings and more compact size, *pre-lubrication* is one more important reason for starting to convert, today, to Life-Line power. Standard ratings available from stock—others on short delivery. Ask your Westinghouse representative for prices and delivery on your requirements, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

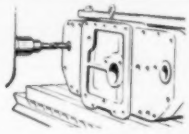
J-21527-A

Westinghouse Life-Line Motors

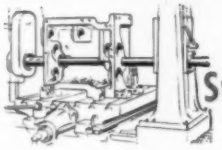


HERE'S LUCAS VERSATILITY

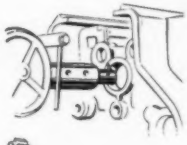
Accurately spaced drilling and boring . . .



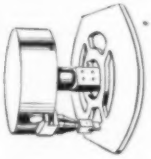
Line boring . . .



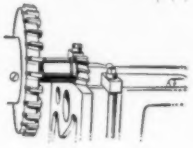
Stub boring . . .



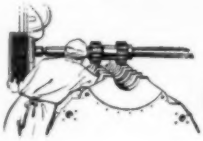
Facing . .



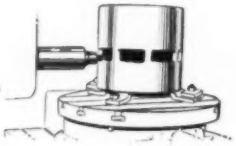
Face and end milling . . .



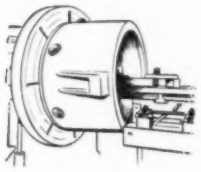
Milling with arbor . . .



Milling with power rotary table . . .



Turning . .



. . . just part of a day's work for a Lucas horizontal boring, drilling and milling machine . . . the precision "one man machine shop." Not just a highly accurate tool room machine, but big and rugged for production work too. So versatile and adaptable, it is rarely idle in any shop.

Mechanically controlled 3" and 4" spindle models. Also 4", 5", and 6" spindles with remote all-direction electrical controls. Work ranges are from 36" x 36" to 94" x 84". All sizes available with either two-way or four-way beds, and feature high and low speed ranges to a single spindle. *Available with automatic power positioning dial indicators for repetitive, close tolerance work.*

Write for descriptive literature.

LUCAS OF CLEVELAND

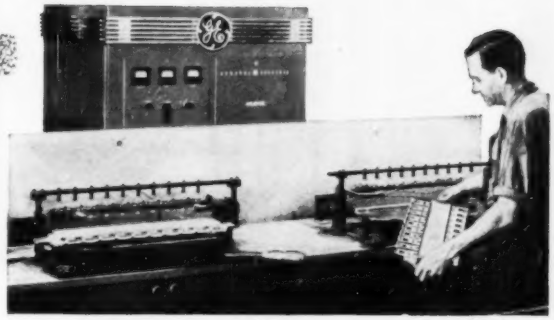
LUCAS

Precision

HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 8, OHIO

ELECTRONIC HEATERS ON THE JOB: SILVER-BRAZING STEEL

fewer rejects lower unit cost production increased: 1600%



INCREASED PRODUCTION of instrument panel trim is a fact at Croname, Inc. Thanks to their G-E induction heater, production of panel assemblies has been boosted from *500 a day to 8,000 a day.*

A two-station work table, which permits studs to be brazed to panels in groups of 10 assemblies, makes it possible for Croname to use their G-E induction heater to full advantage. Two assistants keep the operator supplied with prepared loading boards. The operator in turn loads and unloads one station while heat is being applied at the other.

Net result: a tremendous boost in production of more uniform assemblies with fewer rejects—thanks to induction heating.

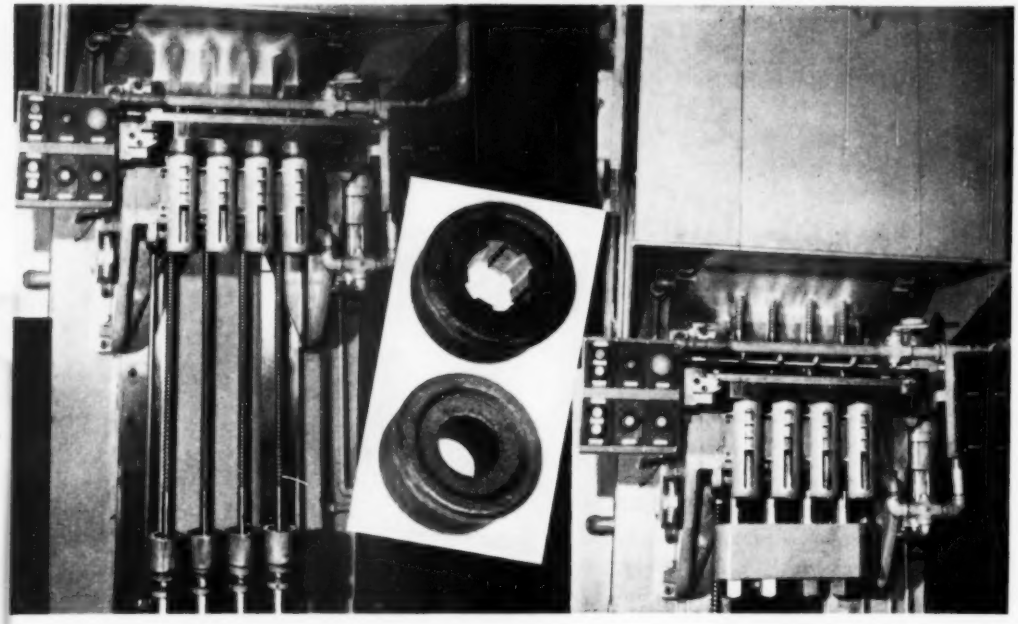
Electronic INDUCTION HEATERS

YOUR PRODUCT AND INDUCTION HEATING

If your production involves brazing, soldering, hardening, or annealing, be sure to get in touch with the Heating Specialist in the nearest G-E Office. His suggestions are very likely to result in higher production, lower cost and better products, as they have for so many other manufacturers. In the meantime, send for free bulletin GES-3290, "The How and What of Electronic Induction Heating." ***Sect. 675-187, Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

for HIGH PRODUCTION BROACHING see *American*



Transmission Maker produces over 600 internally splined hubs every hour with AMERICAN Automatic Broaching Machine.

Full automatic operation which keeps pace with automotive mass production schedules is economical and practical with American engineered broaching machines. Take, for example, the problem of this transmission manufacturer. The part was a steel forged hub blank, which required broaching of an internal diameter and six splines. The production rate specified was high.

American engineers recommended a VP-4-25-36 vertical internal pull up broaching machine arranged with four (4) broaching stations, manually loaded feed unit with hydraulically operated work slide for traversing the parts from the magazine to broaching position.

The slide carries four parts from the loaded magazines to broaching position and lower cylinder automatically starts on up stroke. Broaches are carried through the part to the pull heads, and the first broaching teeth carry up the part and locate it against the work bushings as the broaching stroke starts automatically. At the end of the stroke the parts drop and are automatically deflected to the front of machine, the broaches return to the lower position, and four new blanks are positioned by the slide for the next stroke. The operator need only keep the magazines loaded. The unit was supplied with a motor driven chip conveyor.

Perhaps a semi or fully automatic American type VP broaching machine is the answer to your production problems. They are built in several sizes and tonnages to suit a wide range of internal broaching operations. For more complete information write for new Circular 400. Address Dept. A.

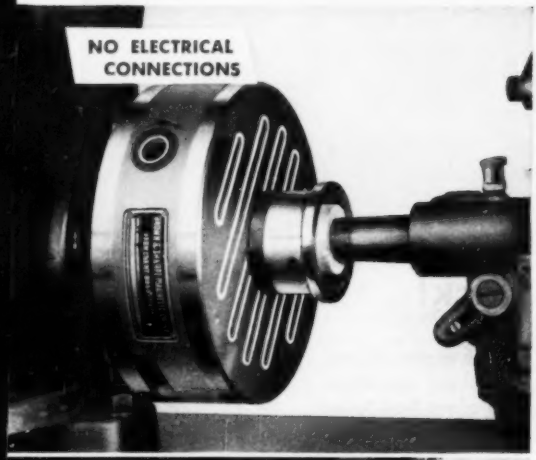
AMERICAN *American* BROACH & MACHINE CO.

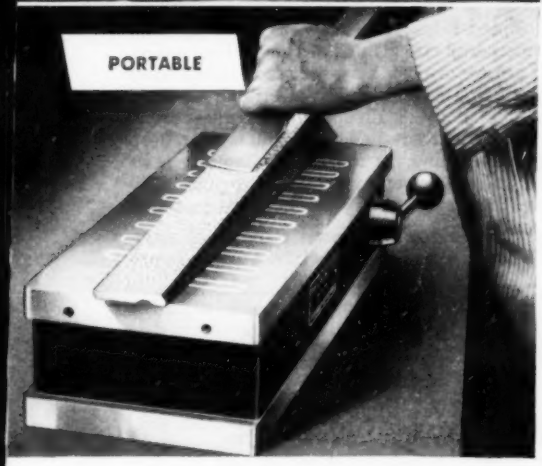
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

Powerful Permanent Magnet Chucks





that simplify layout work, testing, inspecting, grinding and light machine operations

Wherever these Brown & Sharpe permanent magnet chucks are in use, time-consuming holding jobs are made easy — economical. By a simple turn of a lever, work is held securely — another turn releases work instantly. The amount of holding power may be varied to permit accurate positioning of work.

With these chucks, no jigs or fixtures are needed. No clamps. No vises. No risk of distorting work through uneven pressure. The chucks are portable . . . instantly usable . . . and will hold work as long as desired without damage to work or chuck because they do not heat. Used for wet or dry grinding.

WIDE RANGE OF TYPES AND SIZES

Brown & Sharpe Permanent Magnet Chucks are available as follows:

RECTANGULAR MODELS, 8 sizes, to 12⅛" x 36".
ROTARY MODELS, 3 sizes — diameters — 5", 7", 9".

Also available . . . auxiliary top plates, magnetic chuck parallels, magnetic blocks with V or plain face and other useful holding aids.

ECONOMY FEATURES

NO INSTALLATION COSTS
NO OPERATING COSTS
PORTABLE • ADAPTABLE
SAFE • LONG-LIFE
SIMPLE TO USE

For sale only in the United States of America and its Territories. Write for Catalog describing operating principles and specifications. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

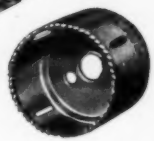
We urge buying through the Distributor

BROWN & SHARPE B·S

Cut...

LARGE HOLES

. . . thru any machineable material up to *ONE INCH* thick!



Here is a premium tool which makes it possible to saw holes in one short operation . . . large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

MARVEL High Speed-Edge Hole Saws come in 35 sizes, from ⅝" to 4½". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-49

"MARVEL" *has Always had the edge!*

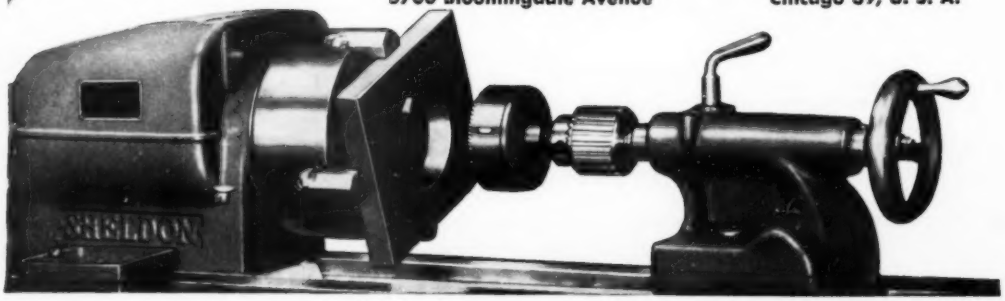
MARVEL *Metal Cutting* **SAWS**

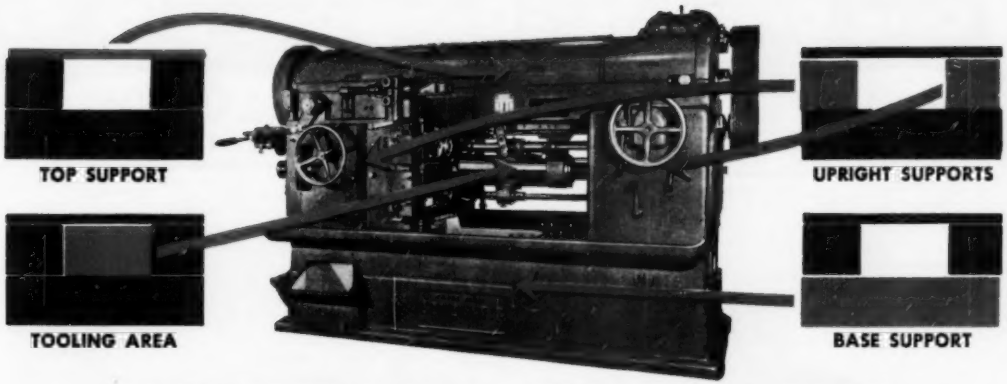
Better Machines Better Blades

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Avenue **Chicago 39, U. S. A.**





GOOD DESIGN IS CONSISTENTLY GOOD

All builders of horizontal type multiple spindle automatic bar machines emphasize the importance of substantial frame support to maintain work and tool alignment and insure durable low-cost machine performance. Some have stressed the advantages of box-type frame design and construction. But only Cone has consistently applied these fundamentals by providing a horizontal, rectangular tooling area for a horizontal type machine. Two frame designs for horizontal type multiple spindle automatics were submitted to automatic users to meet the general requirements here listed. The 100% choice is illustrated above. The Conomatic is its sole representative.

	MACHINE #1*	MACHINE #2	MACHINE #3	MACHINE #4	MACHINE #5
WORK & TOOL CAPACITY	✓				
WORK & TOOL SUPPORT	✓				
WORK & TOOL MAINTENANCE	✓				

*CONOMATIC

Any good investment has certain qualifications that prove it profitable. The wise investor and smart banker have some sort of measuring stick to analyze every investment they make. Why not use a chart to guide your purchases of Automatic Bar Machines? If you are already using a chart, perhaps you would like to compare it with the one that we have prepared. Write to us for a copy or ask your Cone representative.

WORK & TOOL CAPACITY

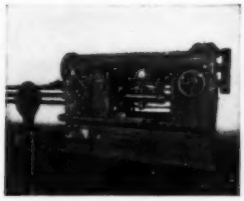
Long, open, roomy Tooling Area and long main end slide for handling longer work and for clearing die heads in threading, etc., to the full collet capacity of the machine; for heavy cross-slide cuts, deep hole drilling, and general all-round work with HSS or Carbide Tools.

WORK & TOOL SUPPORT

Genuine, horizontal, rectangular box-frame free of overhang; heavy-set, rigid upright members for supporting headstock and gear box units between heavy, full-length top and base members, for substantial support of all work and tools close to the work and tool axis, and for the maintenance of accurate alignment of work and tools.

WORK & TOOL MAINTENANCE

Heavy, strong, well supported, overhang-free, vibration-free, liberal bearing, convenient, adjustable, work holding units and tool slides, with accessible chip-free cams, with adequate capacity in base member for chip disposal and cutting coolant.

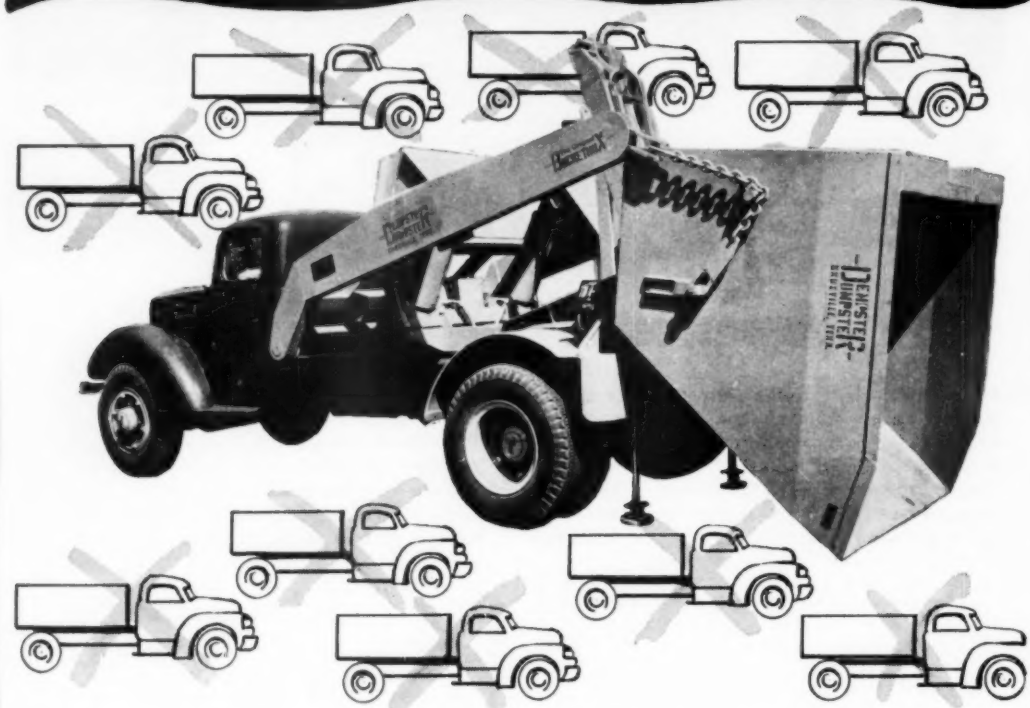


A comparison with ALL Automatics will lead you to

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

One Dempster-Dumpster with 99



Being a large operation, this copper smelter required ten trucks and their crews, a series of push cars, a train car system and loading crews to handle over twenty different kinds of materials on relatively short hauls between plant buildings and outside of the grounds. The materials handled included, scrap of all descriptions, trash, rubbish, new and used brick, excavation spoil, waste oils, filter cake, dust, sand, gravel, cement, fire clay and many others.

A large majority of the handling, re-handling, storage, truck and car equipment and crews standing idle, was eliminated by the Dempster-Dumpster System. Simply stated, this system provides quick pick-up of pre-loaded containers for hauling, dumping or moving material to another location. The three pictures below show how it operates. The left illustration shows the Dempster-Dumpster truck hoisting unit approaching a loaded container. Two chains are attached and the driver returns to controls in the cab. In the center photo, loaded container is hydraulically raised into carrying position. Controls in the cab permit dumping as illustrated at right. You too, may be able to adapt the Dempster-Dumpster System of Materials Handling to your business at tremendous savings. Let one of our engineers discuss this possibility with you.

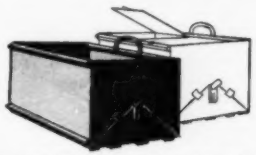
DEMPSTER BROTHERS, Inc.

Containers replaces 9 trucks....

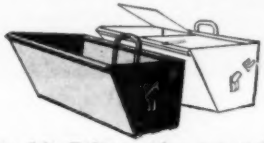
Over $50,000 saved annually . . . in this Copper Plant through faster, more efficient, materials handling

Here, in plain language, is what happened to Materials Handling costs after the Dempster-Dumpster System of Materials Handling was installed in a large Western copper smelting plant. A comprehensive Dempster-Dumpster survey had previously revealed costly delays, unnecessary handling and rehandling of materials, and much time wasted by loading crews. All have been eliminated to the tune of $50,000 savings annually. Fast pick-up, hauling and dumping of pre-loaded Dempster-Dumpster containers has replaced the old method of plant hauling. As a result, nine of the ten trucks formerly detailed for this work were eliminated or put on other work. Ninety-nine detachable containers, built in over 20 sizes and designs for the specific materials they were to handle, were spotted at material accumulation points throughout the plant. Some containers, provided with roller bearing casters, are rolled to indoor accumulation points. Some are handled by fork trucks, other by overhead cranes within plant buildings. As containers are filled, the Dempster-Dumpster truck hoisting unit and one man, the driver, picks each container up, hauls it to its destination, dumps it and returns the empty container for refilling or, loaded container is lowered at any point and left if desired. When you consider that pick-up and dumping of these detachable containers takes less than 60 seconds, and that the entire operation works to an on-the-run schedule, you will realize how one truck hoisting unit can handle 99 containers and do the work formerly requiring ten conventional trucks.

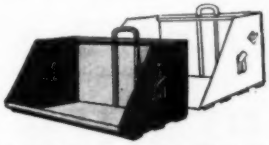
In the panel below are shown the basic types of Dempster-Dumpster Containers used in this installation. The basic containers can be altered with lids, casters, hose and chute connections, etc., to handle accumulations of any type material whether it be liquid, solid, dust, gas, light or heavy materials.



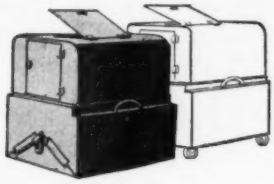
Forty-nine open top, drop-bottom containers in 3, 4, 8 and 10 cu. yd. capacities were spotted at 38 locations throughout the smelter operation. Four of these were 10 cu. yd. containers fitted with two end doors and a circular top opening for chute loading. Three of the 34—4 cu. yd. drop-bottom containers in this group were equipped with self balancing spring lids for special use.



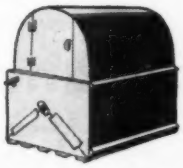
Ten water tight, Tilt-Type containers were required to handle liquids or moist materials. Four of these were open top of 1½, 3 and 4 cu. yd. capacities for four locations. One 4 cu. yd. container with self balancing spring lids was provided at Lab Sample Mill. Three containers, with self balancing lids provided with pipe inlets, were supplied for receiving waste oil at three separate locations. Two 3 cu. yd. containers having three separate compartments with individual lids for each compartment, were required for the zinc electrolytic plant.



Two 4 cu. yd. skip-type, with lip, containers and two 4 cu. yd. skip-type, flat-bottom, containers were spotted at two locations. One 6 cu. yd. flat-bottom, skip-type container was furnished.



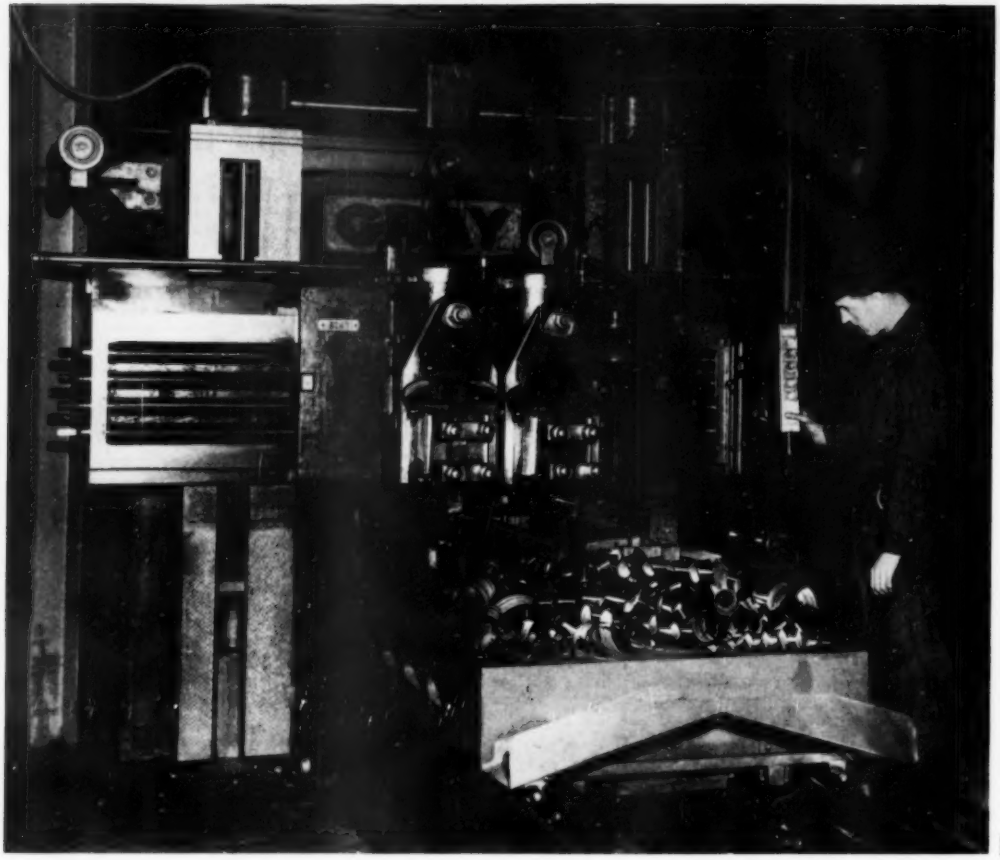
Thirty-three Universal-type containers in 6 and 10 cu. yd. capacities were spotted at 33 locations to receive trash, rubbish and other bulky materials. Two of these were mounted on roller bearing casters for movement to indoor loading locations.



Two 10 cu. yd. Apartment-type containers were spotted at the main office and laboratory office to receive large accumulations of waste paper and trash.

DEMPSTER DUMPSTER
TRADE MARK REG.
SYSTEM

459 DEMPSTER BUILDING, KNOXVILLE 17, TENNESSEE



...for rail and switch planing you need the terrific power and enormous rigidity of the GRAY SWITCH PLANER

The G.A. GRAY Company

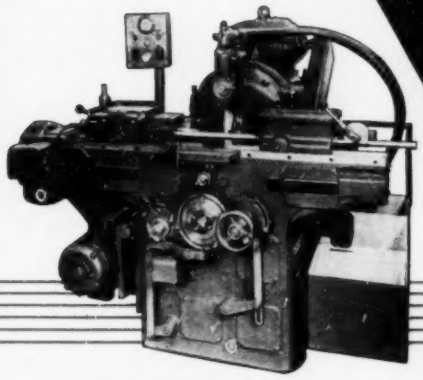
planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

110% DIVIDEND

THE FIRST YEAR*

The New Process Gear Corp., Syracuse, N. Y., threads 80 of these drive pinions per hour.



The threads are finish ground from the solid after hardening, on a 6 x 15" Jones & Lamson Automatic Thread Grinder.

110% of the funds invested in this machine returned to the purchaser during its first year of operation.

*The piece was completely machined, including the keyway in the thread diameter before hardening. A 6 x 15" J & L Automatic Thread Grinder, using a multi-rib wheel, grinds the thread from the solid, hardened pinion in two revolutions of the work piece, plus the feed-in and lap-over. Scrap was reduced 50%. The savings (based on a daily production of 700 units) in direct labor costs, overhead and gage cost, *paid for machine and equipment in 11 months.*

A survey of your turning, threading and inspection operations by our engineers, might well produce comparable results for you. Write to Dept. 710 G

Thread Grinder Division

J&L JONES&LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

Another Lodge & Shipley *Profit Feature!*

Gives you these *Xtras* in *Model* "X" Lathes

The TOTALLY ENCLOSED, dial-operated QUICK CHANGE GEAR BOX on Lodge & Shipley Model "X" Lathes gives finger tip control, instant selection of 55 Threads and Feeds. One of the outstanding lathe developments of the past 50 years, this feature was originated by Lodge & Shipley . . . has now become a "must" for those who have profited by its advantages.

Only on Lodge & Shipley Model "X" Lathes is the TOTALLY ENCLOSED Quick Change Gear Box available in every lathe size, another contribution to lasting accuracy and greater operator efficiency. Look for this outstanding feature on the next lathes you buy. Write for Bulletins No. 676 and 679 which show 14, 16 and 20-inch Model "X" Engine Lathes.

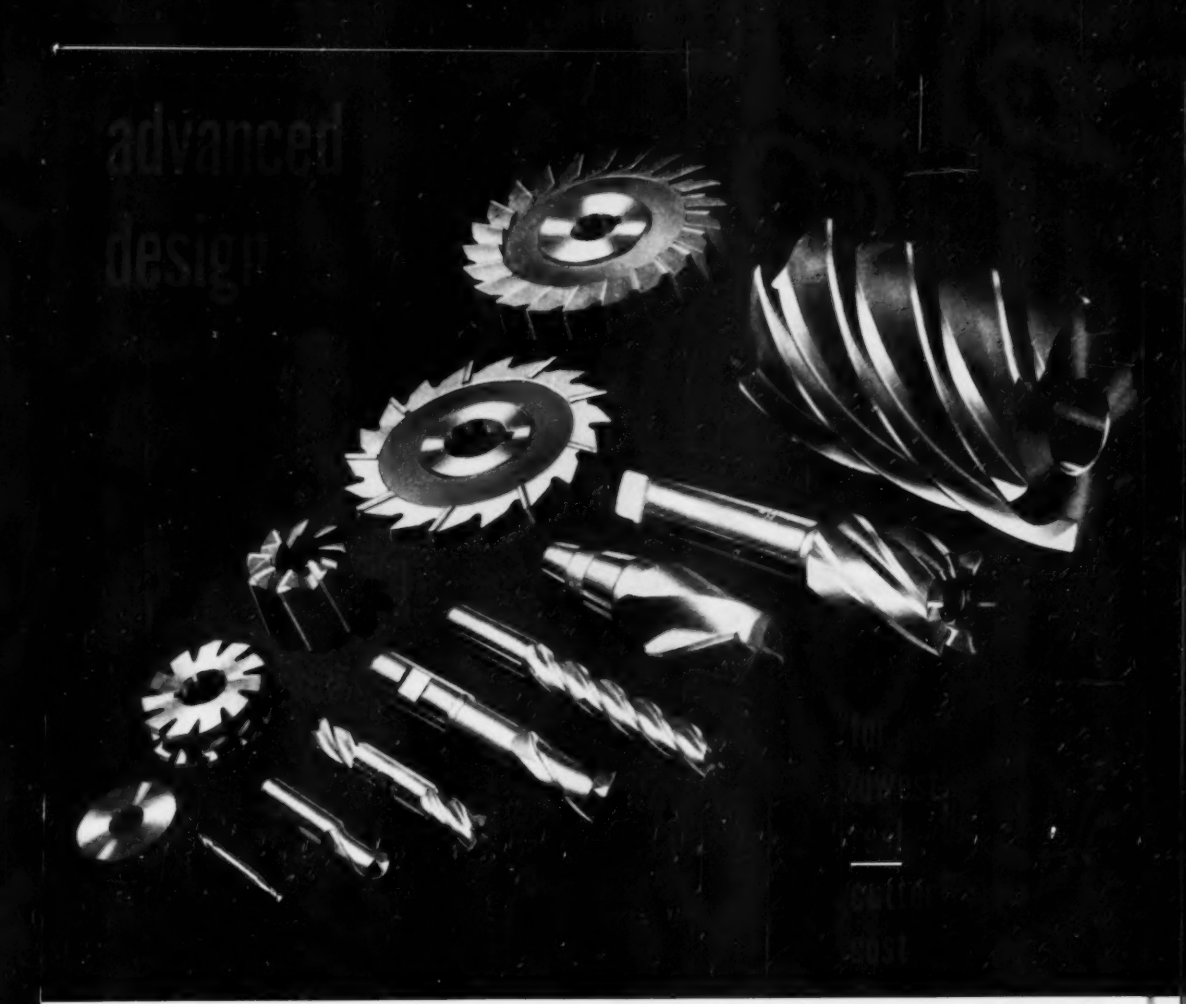
THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

Model Xtra Life—**because the Quick Change Gear Box is TOTALLY ENCLOSED, sealed against dirt, chips, abrasive dusts and tampering, this important mechanism cuts downtime, assures much longer service life.**

Model Xtra Convenience—**because the TOTALLY ENCLOSED Quick Change Gear Box offers finger tip control of 55 feeds and 55 R.H. and L.H. threads, operation is quicker, easier and more profitable.**

Model Xtra Lubrication—**because the Quick Change Gear Box is TOTALLY ENCLOSED, automatic recirculating lubrication is used. Lubrication is not dependent upon the operator. All bearings and gearing are fully lubricated, protected against wear automatically.**



To help you take full advantage of more efficient machines and new materials, Brown & Sharpe engineers are constantly testing and developing new designs in cutters. In the development of the most practical cutters, diversified manufacturing in Brown & Sharpe's own plant provides an exhaustive testing ground.

Brown & Sharpe cutters have many advanced features of design that permit highly efficient operation. Their dependable performance assures *more* as well as *better* work.

Get fully acquainted with all the advantages of Brown & Sharpe cutters—they cost you less in the long run. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

• A COMPLETE LINE OF MILLING CUTTERS

Plain Milling
Helical Plain Milling
Side Milling
Staggered Tooth Side Milling
Inserted Tooth
Angular
Convex and Concave
Screw Slotting
Sprocket Wheel
Gear
End Mills
Metal Slitting Saws

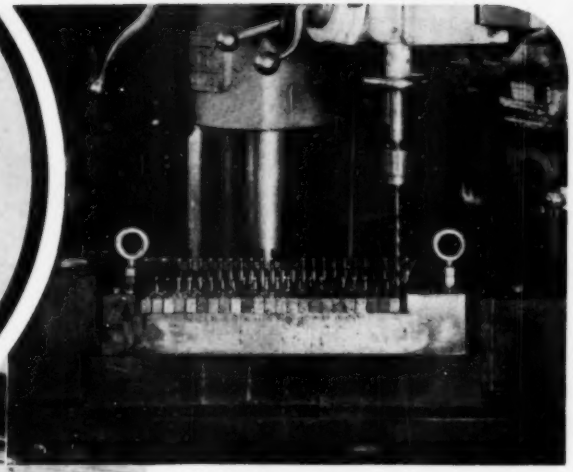
We urge buying through the Distributor

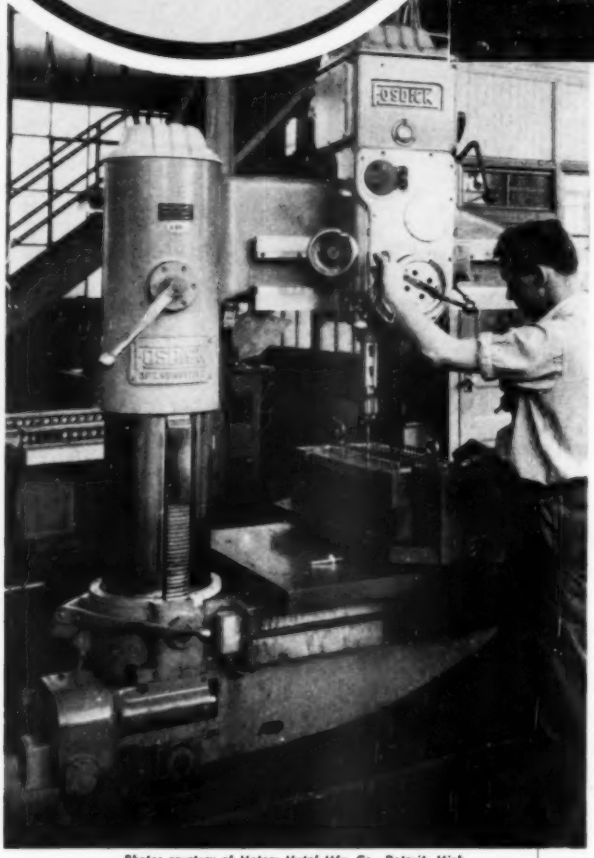
BROWN & SHARPE CUTTERS B·S

If the job requires a series of small holes—at various center distances

...Put it on a

FOSDICK
SENSITIVE RADIAL





Photos courtesy of Motors Metal Mfg. Co., Detroit, Mich.

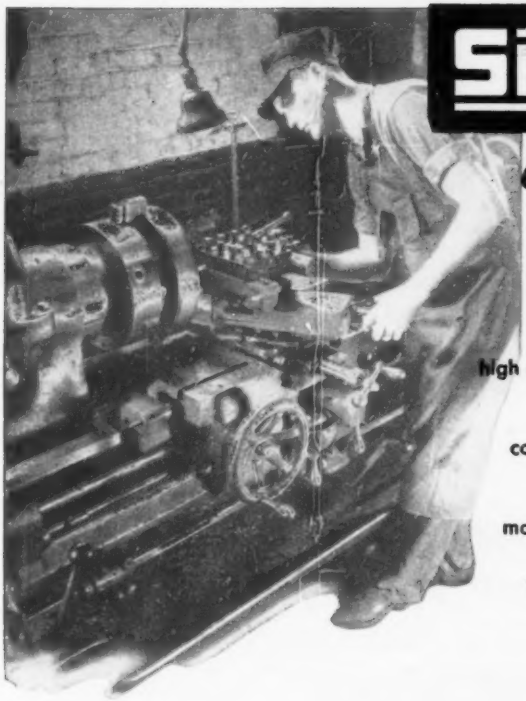
● Here's a sensitive drill of radial design and construction that fills a void in the sensitive drilling field.

With the arm at a fixed height and a distinctly new table which is adjustable on the column, the work is easily located in the proper position for drilling, facing, reaming, etc. Both the arm and the table swing in an arc of 360°.

Take the job illustrated for example, there are a series of pieces mounted in a jig and the jig is placed on the adjustable table. The various holes are easily reached by the operator from his normal working position. All necessary speed and feed changes are contained in the head and both are obtained by means of conveniently located direct reading levers.

It will pay you to investigate the many advantages of the Fosdick Sensitive Radial. For complete details of design—construction—and operation, *write for the new Fosdick Sensitive Radial Bulletin—S.R.A.*

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO



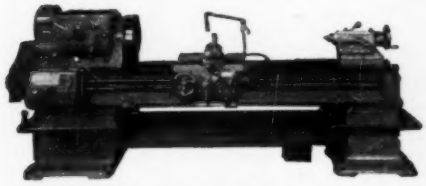
SPRINGFIELD

Geared Head

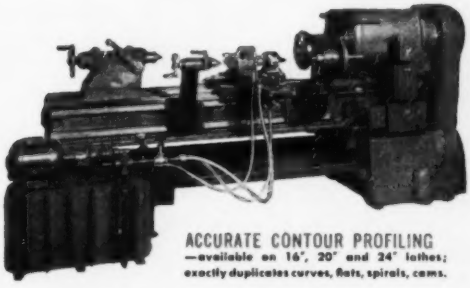
LATHES

Springfield builds a complete line of precision, high quality, geared head lathes. Every type of lathe built by Springfield is especially designed and constructed to meet all the requirements of modern tooling, and to retain extreme accuracy through many years of full capacity production.

Write for catalogs and detailed specifications.

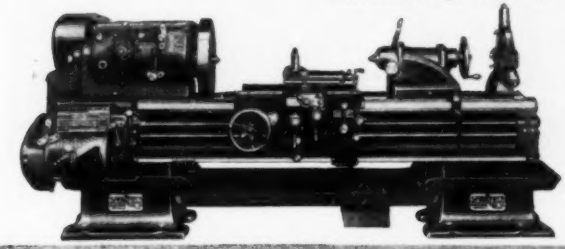


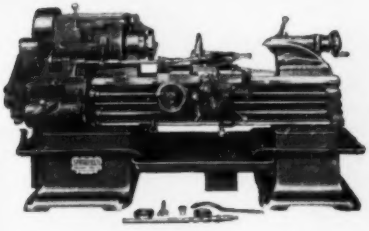
MANUFACTURING LATHE
—with unusually wide applications; capable of accurately turning, boring and facing.



ACCURATE CONTOUR PROFILING
—available on 16", 20" and 24" lathes; exactly duplicates curves, flats, spirals, cams.

SUPER DUTY LATHES
—made in 20" and 22" sizes; equipped with 16-speed geared heads.





TOOL ROOM LATHES
—made in all sizes including 24"; equipped with lead screw reversing mechanisms.

THE SPRINGFIELD MACHINE TOOL COMPANY

SPRINGFIELD, OHIO, U. S. A.

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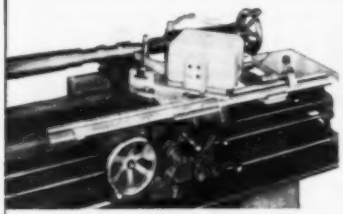
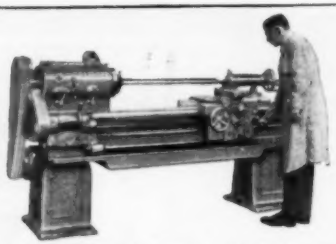
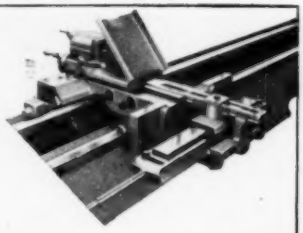
Exclusive Representatives in All Principal Cities



ELECTRIC DUPLICATING ATTACHMENT — Fits any LeBlond Regal or Dual Drive . . . excellent for duplicating work between centers or for profile facing . . . complete your students' education with this new attachment.



ELECTRIC BRAKE Standard on 21", 24" Regals, available as extra equipment on all other models . . . stops spindle in less than a second. Speeds all turning operations.

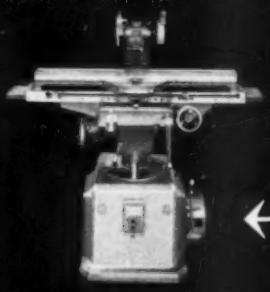


TAPER ATTACHMENT Heavy duty telescopic type . . . an important attachment for training lathes . . . demonstrates modern method of turning tapers of all kinds . . . available for all new Regals and Dual Drives.

for realistic training

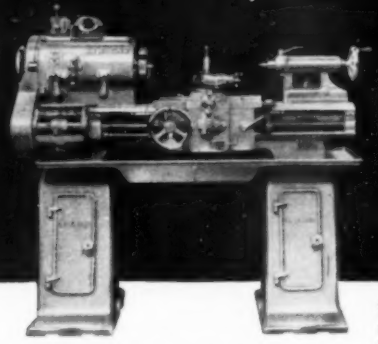
SPECIFY LeBLOND LATHES . . .

CUTTER GRINDERS AND ATTACHMENTS.



the LeBlond No. 2 Cutter Grinder with exclusive 4 speed stationary wheel head construction

the new LeBlond Dual Drive with 12 speed combination gear-belt drive headstock



LeBlond Regal lathes in six swing sizes 18" to 24"

THE R. K. LeBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

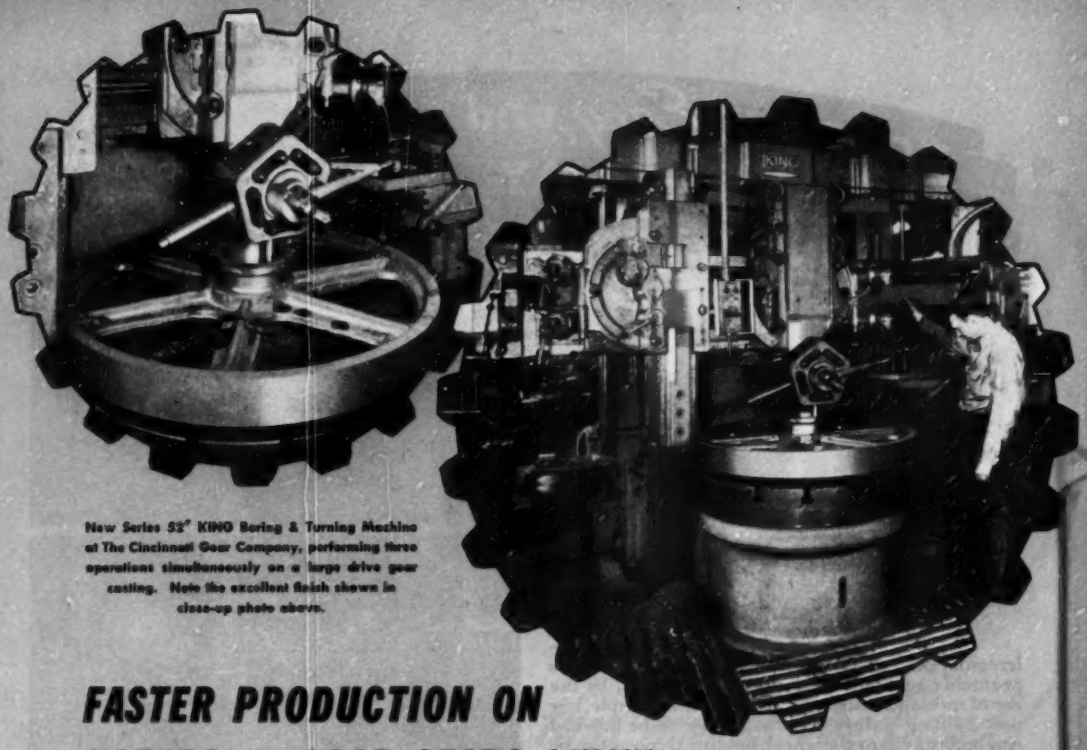
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES.

SALES OFFICES: New York, Chicago, Philadelphia, Detroit.

for information

- ☐ Regal Attachments Bulletin R-181
- ☐ No. 2 Cutter Grinder Bulletin CG-251
- ☐ Regal Lathe Bulletins 13" to 24".
- ☐ Dual Drive Bulletin No. 2.

LeBLOND



New Series 52" KING Boring & Turning Machine at The Cincinnati Gear Company, performing three operations simultaneously on a large drive gear casting. Note the excellent finish shown in close-up photo above.

FASTER PRODUCTION ON "GEARS . . . GOOD GEARS ONLY" WITH THIS VERSATILE *New Series* KING

THE CINCINNATI GEAR COMPANY, makers of "Gears . . . Good Gears Only", find their New Series 52" three-head KING a top performer in speeding production of large and medium-sized gears. As many as three machining operations are accomplished simultaneously – as shown in above photos.

Whether the job is large or small, the smooth power, extra rigidity, and all-around versatility of the New Series KING will handle it fast, accurately, at less cost.

Massive construction, a powerful main drive, greater range of feeds and speeds, time-saving ease of control – these and other outstanding advantages in the New Series KING are *your* direct route to stepped up production and profits.

KING Vertical Boring & Turning Machines are made in ten sizes: Single Column – 30", 36", and 42" swing; Double Column – 52", 62", 72", 84", 100", 120", and 144" swing. All sizes are available with or without side head, in a variety of head combinations. Complete specifications supplied promptly on request.

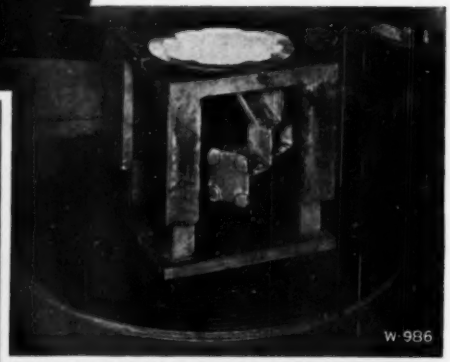
American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

DO IT THE *Easy* and *Profitable* WAY



Here are three excellent examples of large irregular pieces being finished more easily and more profitably on Blanchard Surface Grinders, by the use of specially designed, extraordinarily simple, low cost holding fixtures. If the surface to be finished can be brought to the wheel, holding fixtures can be designed to hold the work for Blanchard Grinding.

Blanchard will gladly assist you in designing such holding fixtures, or design and furnish them at low cost.

Put it on the BLANCHARD

HOW ELSE CAN YOU GET RESULTS LIKE THESE?

W-894 Cast iron chain idler brackets were ground from rough casting to commercial finish. Grinding reduced the per-piece machining time to 3/10 that necessary when a miller was used. It was put on the Blanchard.

W-957 Ten costly hours were saved finishing this milling machine universal saddle. Formerly an 11-hour hand-scraping operation, the time was slashed to 50 minutes. It was put on the Blanchard.

W-871 These cast iron Bearing Gibs had ⅛" removed from each of the four sides. Finished edges were accurately square with sides. Production rate was tripled. They were put on a Blanchard.

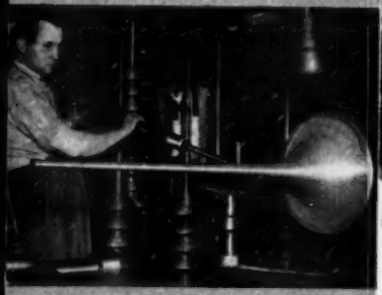
Send for your free copies of "Work Done on the Blanchard" and "The Art of Blanchard Surface Grinding"

BLANCHARD

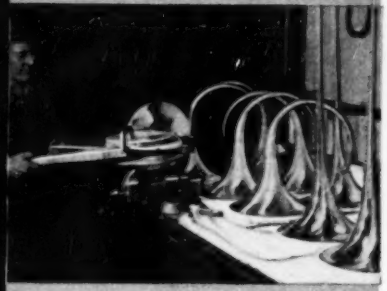
The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

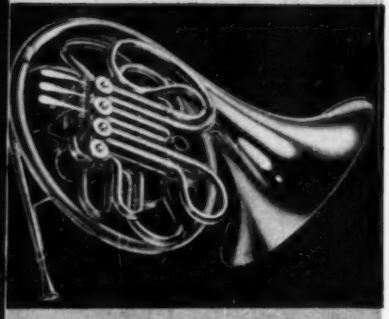
Forming the bell of a French horn is a highly skilled operation in which the bell bottom is spun from a flat disc of brass. Not only is the bell shaped, but the metal thickness is reduced.



The stem is formed from cartridge brass strip, 11" wide x .0179" thick. It is brazed on the seam and then brazed to the bell. The final spinning operation is over a tapered mandrel.



To obtain a uniformly smooth contour, both inside and out, the bell and stem are filled with pitch before bending on this bench fixture.



Skipping several hundred operations, we come to the finished instrument. It is now checked for pitch on the Conn Electronic Tester that measures tonal accuracy to 1/100th of a semi-tone.

It's BRASS that makes the Band!

When Col. C. G. Conn, the colorful Elkhart grocer who played in the town band, abandoned the cracker barrel for the tuba and the trombone in 1875, he bent his first horns to shape around tree trunks. But he started the industry that has made this nation the most musical on earth . . . a nation of three million young musicians, of 30,000 school bands and 35,000 school orchestras.

Since those early days, throughout the evolution of the Conn factory from a board shack to the largest and most modern in the world, Conn Instruments have been made from Brass and Nickel Silver supplied by The American Brass Company.

Well-known to both musicians and metal craftsmen are the many advantages that make brasses and other copper alloys indispensable for musical instruments. Only these metals can produce the tonal qualities desired . . . and only their ductility and ready workability can produce the flowing curves, the graceful tapers and glistening bells of modern band instruments.

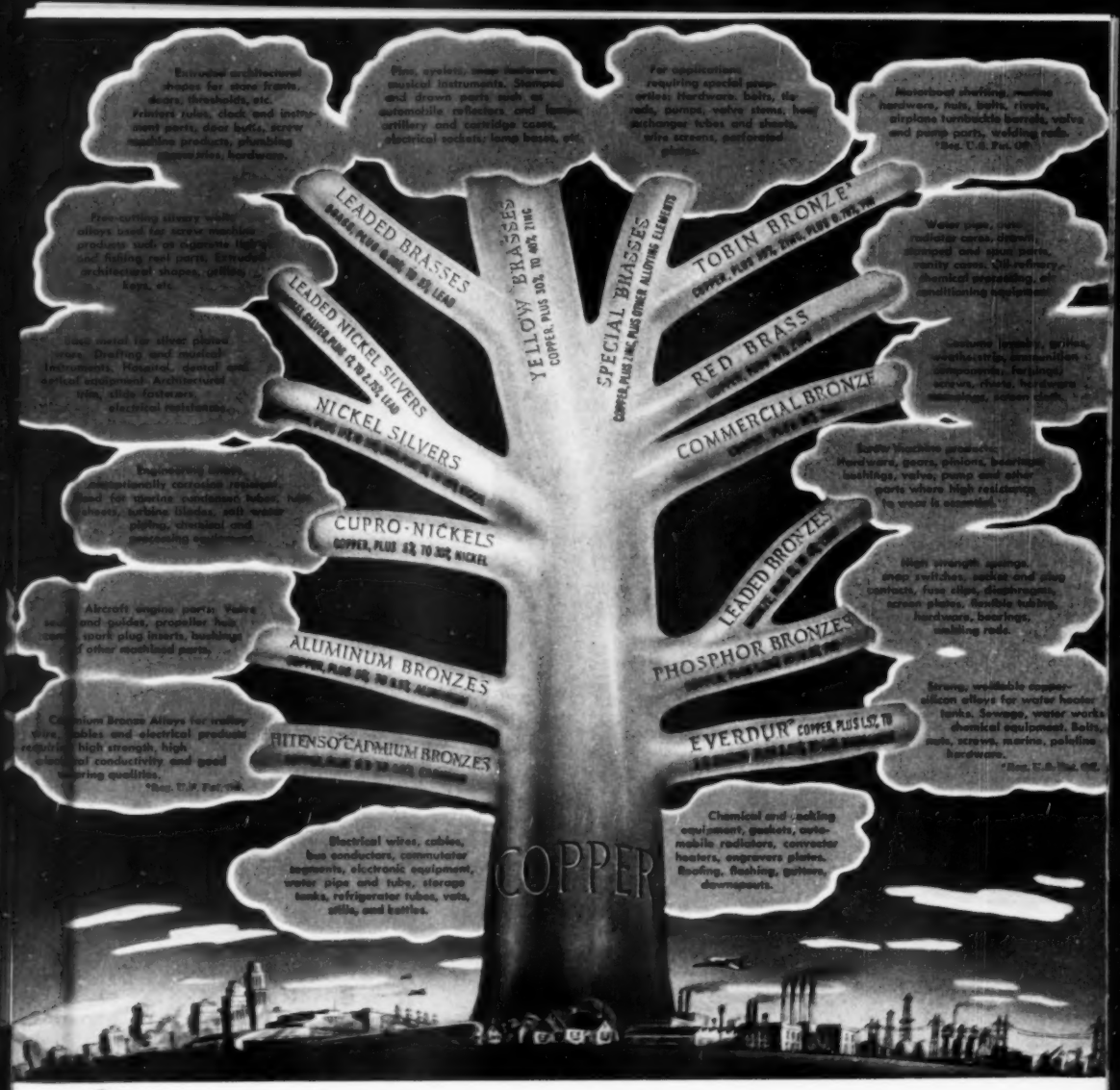
"We have always found," writes Conn, "the copper alloys furnished by The American Brass Company to be consistently uniform in the properties so essential to our operations. And when we say this, it should be borne in mind that our standards of material testing and tonal precision are without equal in our field."

Uncompromising metal standards such as those set by C. G. Conn Ltd. are the expected thing in industry after industry specifying Anaconda Copper and Copper Alloys. How varied these industries are, and the alloys they require, are graphically indicated on the next page.

ANACONDA

THE AMERICAN BRASS COMPANY

General Offices: **Waterbury 88, Connecticut**



Copper is the trunk of an indispensable family tree

The copper family of alloys is versatile, indeed. These dependable metals have contributed to the development of practically all technical and industrial progress. Other metals may have more distinctive properties. Chromium is harder; magnesium is lighter; silver has higher conductivity. But . . . of all commercial metals, copper and its alloys *combine to best advantage* a range of physical and chemical properties not found in any other group.

These properties include a high degree of corrosion resistance; high tensile strength and fatigue resistance; ductility, hardness and toughness; ready weldability; resistance to abrasion; hot or cold workability; machinability, and high thermal and electrical conductivity.

Yet, these very properties, singly or in combination, can be varied considerably by metallurgical adjustment of composition and by changes in the technique of fabrication.

Our Technical Department will be glad to work with you in selecting the best metal for a specific application. 49123

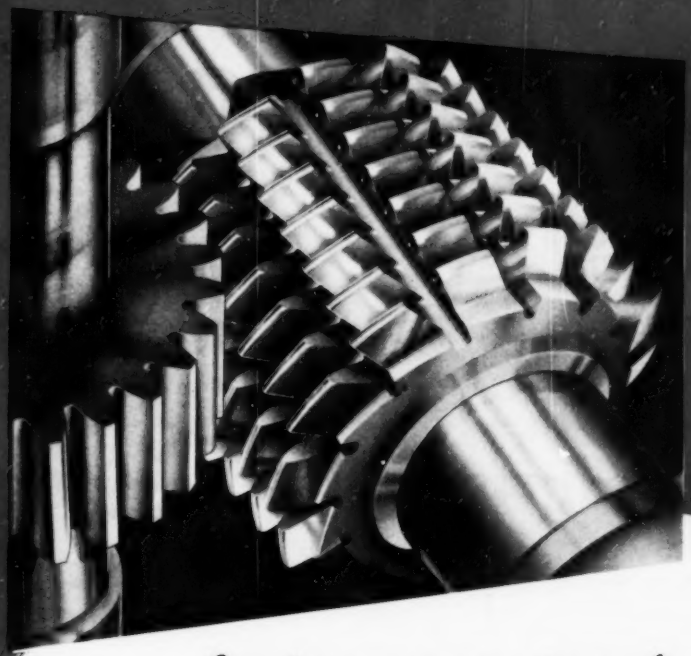
ANACONDA **THE AMERICAN BRASS COMPANY**

General Offices: Waterbury 88, Connecticut

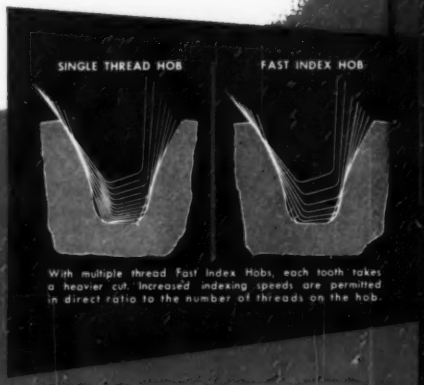
Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Anaconda Copper Alloys



faster gear production...
with FAST INDEX HOBS



With multiple thread Fast Index Hobs, each tooth takes a heavier cut. Increased indexing speeds are permitted in direct ratio to the number of threads on the hob.

Investigate the cost-saving possibilities of Fast Index Hobs by Illinois Tool Works. Where tolerances and finish requirements permit, Fast Index Hobs allow greatly increased indexing speeds and remove more metal with each revolution. They will help you exploit the full production capacity of your present machine tools. Call your Illinois Tool Works field engineer to discuss the application of the new Fast Index Hobs to your work today!

ILLINOIS
TOOL WORKS

2501 North KEELER AVE., CHICAGO 39, ILLINOIS
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

HEADQUARTERS FOR ENGINEERED CUTTING TOOLS

ARMSTRONG

ARMALOY

Drop Forged

WRENCHES

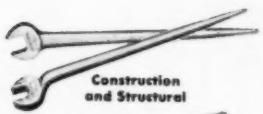
ARMSTRONG ARMALOY — Wrenches are NEW. They are designed to meet the requirements of the mechanic who knows his tools and insists on using tools of Superior Quality.

ARMSTRONG ARMALOY — Wrenches are made from selected grade alloy steel. They are longer, lighter, thinner, yet stronger than the conventional alloy wrenches—heat treated to exact specifications of stiffness and tensile strength—better balanced, hence easier to use. Finished in chrome plate with heads buffed bright.

Armstrong Tools are stocked by leading tool departments.

Combination

Box Socket



Construction and Structural

Hex Box

Reversible Ratchets

Detachable Sockets and Sets

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People."

5215 W. Armstrong Ave. Chicago 30, Ill.

IT'S EASY to see how Cimcool° lowers metal cutting costs—particularly when it's right in your shop, in your machines. This revolutionary cutting fluid—a **chemical emulsion**—saves money three important ways.

1. LONGER TOOL LIFE (and therefore less down time) because of Cimcool's chemical lubricity.

2. FASTER SPEEDS are possible because Cimcool cools faster, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.

3. CIMCOOL COSTS LESS than old-fashioned cutting fluids because it lasts longer in the machine and reduces the cost of cleaning and changing. It virtually eliminates rancidity and foul odors. Due to low surface tension and low adhesion to work and chips, there is practically no carry off.

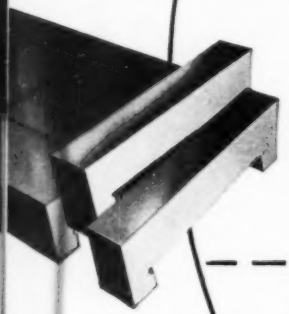
Write for free booklet, "Cimcool Gives the Answers." Address, Sales Manager, Cimcool Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U. S. Pat. Off.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

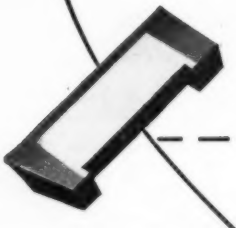
for 85%
OF ALL METAL CUTTING JOBS

How Hard *are GISHOLT'S Hardened Ways?*



to show you . . .

We took a section from the bedways..



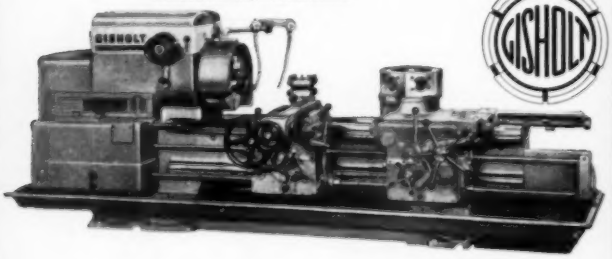
made it into a tool bit . . .

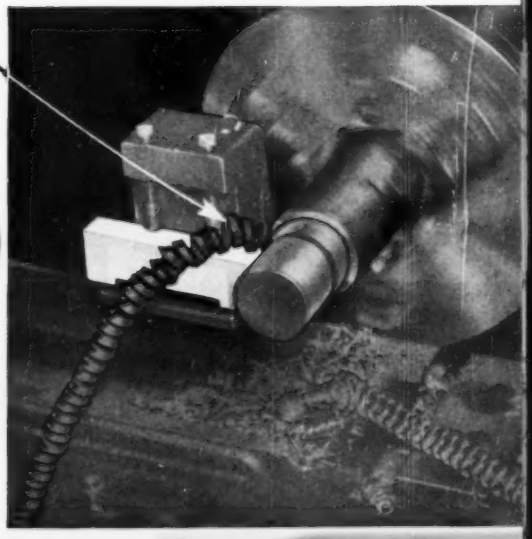
and cut metal with it!

Here it is, turning a shaft of 1045 cold rolled steel. This illustrates how precision is "hardened" into Gisholt Turret Lathes with all working surfaces hardened to 64-66 Rockwell C on ways, gibs and clamps. This extreme hardness makes Gisholt ways practically wearproof—insures lifelong accuracy—the kind of accuracy you want specified in your next turret lathe.

GISHOLT MACHINE COMPANY

MADISON 10, WISCONSIN





TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS
BALANCERS • SPECIAL MACHINES

Get All-Around Motor Protection with

SAFETY-CIRCLE

THAT SOLID CAST IRON FRAME protects SAFETY-CIRCLE working parts against physical damage from every angle. The completely enclosed bottom provides extra protection and extra strength. End brackets are drip-proof at no premium.

Because the frame is cast iron, it is resistant to rust and corrosion. It withstands physical abuse and will not distort.

Protected Inside, Too

SAFETY-CIRCLE protects against internal breakdown with multiple-dipped and baked stator and die-cast aluminum rotor. *Ball bearings are factory-lubricated and need no attention for years.* Wide open internal construction and large fans keep temperatures well within rated limits.

Don't be satisfied with a motor that gives you less than full protection. Insist on the extra protection of SAFETY-CIRCLE.

For complete details on SAFETY-CIRCLE advantages, see your A-C Authorized Dealer, Sales Office, or write for Bulletin 51B6210B. Sizes from 1 to 20 hp, 326 frames and smaller. Safety-Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

A-2689

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MILWAUKEE, WIS.

ALLIS-CHALMERS

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Applied . . .
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by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

Van Keuren WIRE TYPE PLUG GAGES

Giant's Grip
0.500"-1.000"

Safety Bushing
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Wafer Type
1/30th oz.
0.002"-0.020"

TOOL STEEL
•
HIGH SPEED
•
CHROMIUM PLATE
•
VK CARBOLOY

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies now free upon request.

Full 1⅞" and 2" length units may be cut to make 2, 3, or 4 gages . . . Always accurate. No rejections. Long life aluminum handles. *Prompt delivery from a stock of 2 million wires.*

Wire type plug gages were originated by The Van Keuren Co. in 1925. They have resulted in gigantic savings for American Industry and have been widely imitated.

Only in Van Keuren Wire Type Plug Gages is the maximum value of your gage dollar fully realized. The light aluminum handles are especially designed for utility, holding power and long life. The full length gaging units have a uniform high hardness, exceptional finish, long wearing qualities and superlative accuracy.

You do not need to inspect Van Keuren Plug Gages. Our double inspection at the factory takes care of that expense for you. There is no time lost waiting for replacements.

Van Keuren prompt deliveries will enable you to cut your gage inventory to a minimum.

On your next order specify VK Wire Type Plug Gages. VK Carboloy for long runs or fussy jobs. VK Chromium Plate, VK High Speed Steel or VK Alloy Tool Steel for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

FOR SUPERSERVICE Phone Watertown 4-4394

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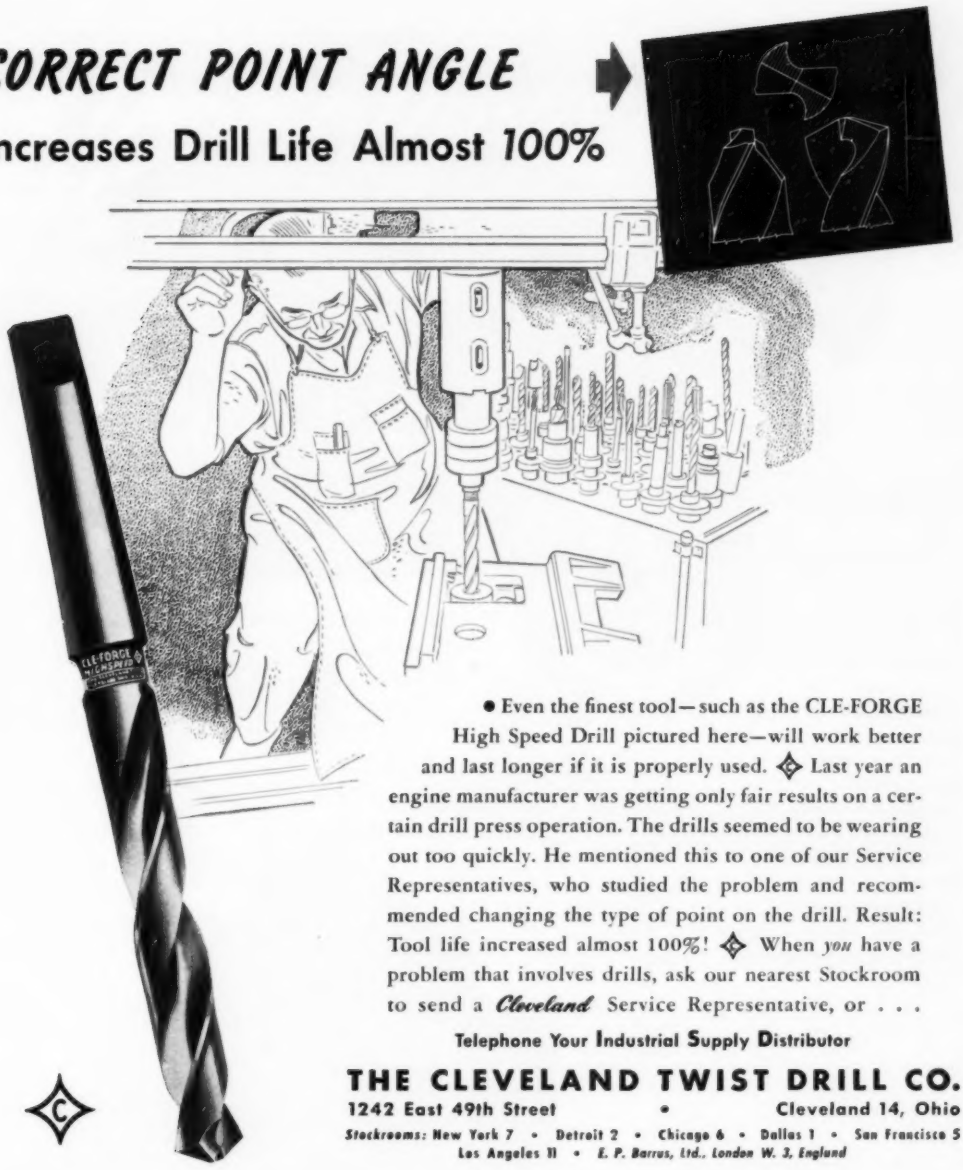
30th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

CORRECT POINT ANGLE

Increases Drill Life Almost 100%



● Even the finest tool—such as the CLE-FORGE High Speed Drill pictured here—will work better and last longer if it is properly used. ◈ Last year an engine manufacturer was getting only fair results on a certain drill press operation. The drills seemed to be wearing out too quickly. He mentioned this to one of our Service Representatives, who studied the problem and recommended changing the type of point on the drill. Result: Tool life increased almost 100%! ◈ When *you* have a problem that involves drills, ask our nearest Stockroom to send a *Cleveland* Service Representative, or . . .

Telephone Your Industrial Supply Distributor

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5
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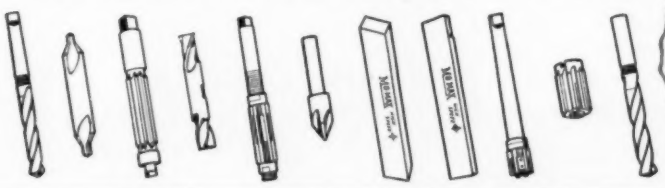
ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS



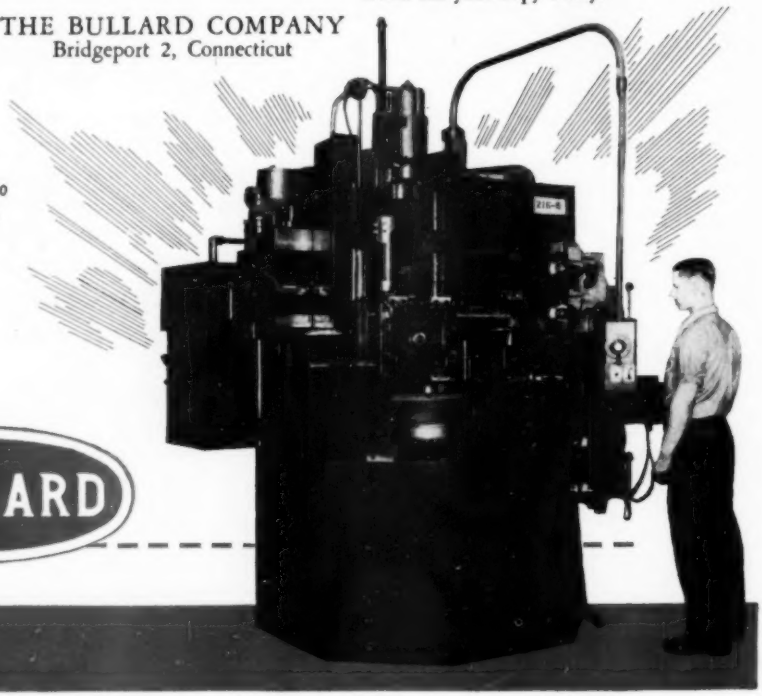
Leading manufacturer of construction equipment reports:

Cast Iron Drive Wheels Machined 5 Times Faster on a BULLARD Man-Au-Trol V.T.L.

Here are shown before and after shots of a cast iron drive wheel for a Motor Grader, machined on a 30" BULLARD Man-Au-Trol Vertical Turret Lathe by Austin-Western Company, Aurora, Illinois. The former method, employing two machines, took 1-9/10 hours. On the BULLARD Man-Au-Trol V.T.L., actual cutting time was reduced to 20 minutes . . . a time saving of 82.4%

No other machine offers such a cost-lowering combination of productivity, versatility and accuracy as a *BULLARD* Man-Au-Trol Vertical Turret Lathe. Bulletin MAV-G-4 tells you why. Write for your copy today.

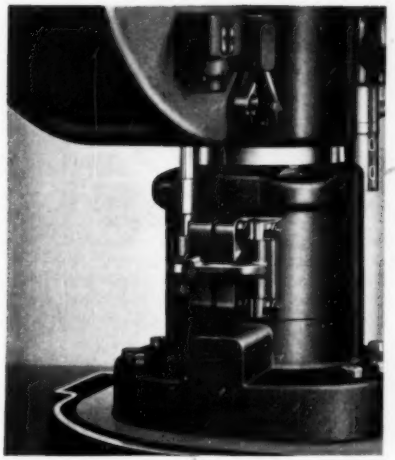
THE BULLARD COMPANY
Bridgeport 2, Connecticut

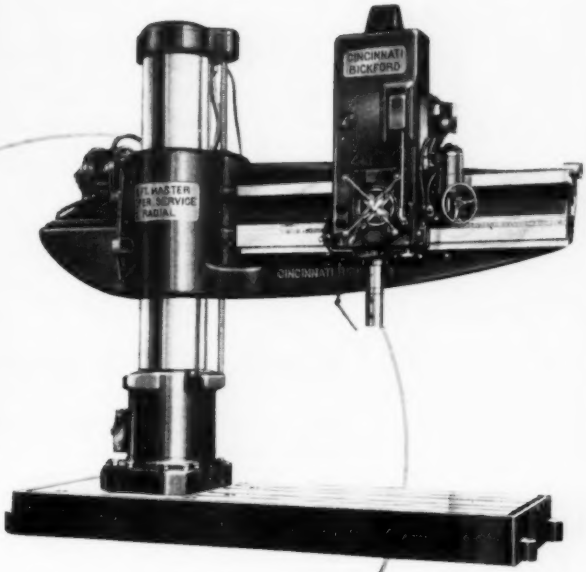


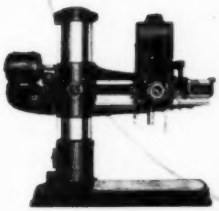
BULLARD

New Things—

that are an OLD STORY...







The Super Service hydraulic arm and column clamping—push button controlled from the head—is dependable, rigid, and is a factor in the outstanding accuracy of Cincinnati Bickford Super Service Radial Drills.

Behind this feature are many years of development, plus ten years of use in the field—Bickford engineering is both precise and up to date.

Now Bickford hydraulic arm and column clamping is standard—starting with 11" diameter column, and up through the large 26" diameter column machines.

The great range of speeds and feeds, and step-saving controls centralized on the Super Service "clear view" head, increase production.

Long life and low maintenance are well-known features of Cincinnati Bickford Super Service Radial Drills.

They are profitable, accurate and productive.

Write for Bulletin No. R-29, covering the 11" to 19" diameter column—and Bulletin R-22 on the 22" to 26" diameter column.

THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT DRILLING MACHINES

SUPER SERVICE

Radials 7½" dia. col., 2½" arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

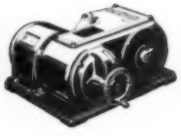
Guess which twin has the Reeves-equipped machine!

THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 10 hp.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



There's not much profit in scrap! By installing 265,000 accurate, instantly and infinitely variable REEVES Speed Control units on machines in their plants, the managers of 25,000 industrial companies have insured uniformity of processing and production which keeps losses of time and material at a minimum. With the ability to adjust machine speeds at will for best results, operators and machines turn out more work, better work, at lower cost. Want to know more? Then ask without obligation, for a factory and field trained REEVES Speed Control Engineer to call, or send for Catalog A12-450A.

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Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

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GIVES THE RIGHT SPEED FOR EVERY JOB!

SPOT NEWS OF METALWORKING

The Army has asked permission to reprint standard materials specifications set up by one metalworking industry and classify them as "secret"!

Distribution of phantom orders for cutting tools has been held up until the battle is resolved over the appointment of Wallgren as chairman of National Security Resources Board. Major action on all key problems in NSRB is reported paralyzed until a new chairman is confirmed.

New aluminum alloy, 150S, has been developed by Permanente Metals Corp. Purported to be the first general-purpose specification alloy introduced in many years, it is of special interest to refrigeration, appliance, utensil and building materials manufacturers. It was used during testing for such diversified products as vending machine parts, irrigation pipe, fruit lugs and store shelving. Its properties are between alloys 3S and 52S.

Indian government is about to award contract to U.S. company for erection of full-sized plant to process oil from coal. Award is to be made in a "package" which will call also for erection of fully integrated steel plant. Total overall sum involved is reported to be more than half a billion dollars.

Thirty-hour week and six-hour day is being sought by midwestern local of United Electrical Workers. It wants overtime for all work over six hours a day or 30 hr a week, with double-time for more than six hours on Saturdays.

More labor men will be filling high government posts in a non-labor capacity. Latest is John E. Gross of Denver, former president of Colorado Federation of Labor and prominent in International Association of Machinists. He is head of ECA mission in Norway.

Czechoslovakia and Poland are cooperating in manufacture of engine lathes and internal combustion engines. Standardization of railway trucks, freight barges and mine equipment is contemplated. The two countries are to work together in building experimental stations for locomotives, shipyards, factory for textile machinery and tractor manufacturing plant. Czechoslovakia will supply spare parts to Polish engine factories.

Protective duties on cutting tools and other small tools are being considered by India, which now has three major manufacturers, four smaller companies and two prospective firms in that field. In 1937 there was only one such producer in India. Today, domestic producers can supply 1 million twist drills a year, contrasted with estimated demand for 400,000.

Gray iron foundries have increased their share of the total castings market by 9% in the last six years, according to R. L. Collier, executive vice president Gray Iron Founders' Society. Last year gray iron comprised 78% of all castings, output exceeding 12 million tons.

Specifications for a new line of machine tools for shipboard use have been put out by the Navy. They call for resistance to a very heavy shock load.

U.S. watch maker, experimenting in pilot plant with new production methods and new machinery, has found that it can compete successfully against the Swiss. In old plants with old machinery in use, costs were so high that no profits could be made competing against Swiss prices.

Exports of machinery and of vehicles jumped almost 20% in March above the February level to $332.8 million. Total exports were up to $1,152.3 million, best showing for the year to date.

Gaging Metalworking

There is no clearly defined trend in metalworking just now. Layoffs are being made here and there as backlogs sag. In some lines, by contrast, a seasonal pick-up is reported. But the feeling exists that the gain is not as much as it should be.

► Even in the automotive industry, things ahead do not appear too rosy. The second and third quarters will be big, but no one yet knows what the last four months of the year hold in store. Meanwhile strikes and threatened strikes are a handicap to car assemblies.

► Industrial machinery demand, in general, is not as brisk as it was. But keep in mind that by prewar standards, business still is excellent. Farm implement, tractor and road-building equipment are doing well. It will be a tremendous year in all of these lines. The same goes for locomotive manufacture and railroad car building, despite a falling off in new orders.

Some Defense Orders Placed

April is believed to have been a smaller month in machine tool orders than anticipated, though official figures are not yet at hand. ECA is yielding more business; and that is good news to the industry. Foreign orders are reported to have kept up to a good ratio to the total for the month.

► Some dealers and builders were aided by sizable chunks of defense business, at least part of which came from the engine program of Wright Aeronautical Corp. Domestic sales of machine tools, on the whole, have been on the slow side, however. Buyers appear hesitant. Some wish to find out what turn business will take before making further investments. Others want to know what is going to happen to taxes and to labor legislation.

► Inquiries are numerous and from good sources, hence the feeling still is that 1949 will prove to be a $300-million year for the industry. However, a substantial portion of the industry is operating either on a 32-hr. schedule or with curtailed working forces on a 40-hr. basis.

► It is possible that a stepped-up military procurement program might bring in some unanticipated machine tool orders. But the industry's hopes are not high on this point.

Military Goods Orders to Rise

Military hard goods procurement during fiscal 1950 (July to July) will be on a heavier schedule than this year. Total expenditures should be about $3.59 billion for planes, ships and other major items such as tanks, trucks, guided missiles and various weapons. Though almost that sum was obligated in the current fiscal year, much of the money thus pledged will not be paid out until fiscal '50 when delivery is actually made.

► Plane and plane parts procurement will stay about the same as this year: around $4.72 billion. Shipbuilding, on the other hand, will plummet from this year's $280 million to $52 million next year.

► Ordnance items, and other general hard goods (ammunition, tanks, trucks, jeeps, guided missiles, tools) have been budgeted at $818 million. That is a stiff jump from $582 million currently.

Gear Volume Improves

The American Gear Manufacturers Association index for March shows volume for the gearing industry to be increased by 5.95% compared with February. The March figure is 299.1. (1935-39 equals 100.)

► Shipments of resistance welding equipment in March jumped 14% over the previous month, the Resistance Welder Manufacturers Association reports. Shipments of resistance welding electrodes—best guide to the utilization of resistance welding equipment—reached a new high for the year to date, being approximately 11% in excess of February and 8% ahead of the longer month of January.

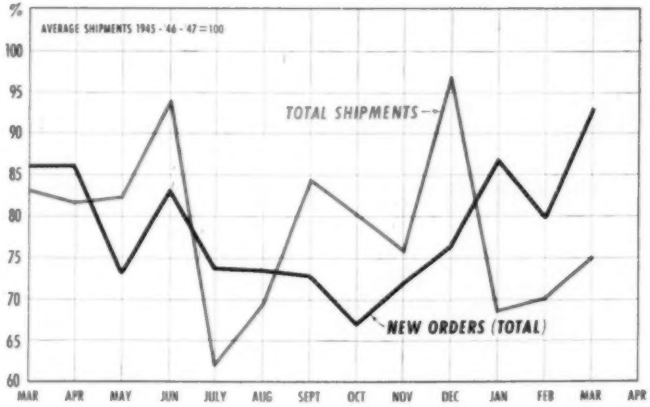
Washer Sales Pick Up

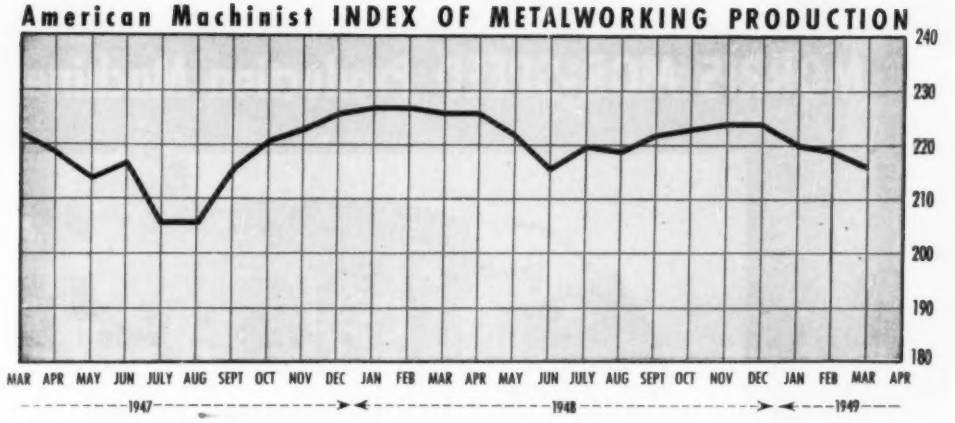
Washing machine sales for March continued to pick up from the sharp downturn registered late in 1948, totaling 254,300 standard-size units compared to 177,900 in January, and an advance of 21.9% over 208,500 units in February. American Washer and Ironer Manufacturers' Associa-

MACHINE TOOL ORDERS AND SHIPMENTS FOR MARCH SHOW INCREASE

Date	New Orders (Total)	Foreign Orders (Included in Total)	Shipments (Total)
(1948)			
Mar.	86.3	16.1	83.6
Apr.	86.3	14.1	82.0
May	73.5	11.4	82.6
June	83.4	11.9	94.4
July	74.0	13.3	62.4
Aug.	73.7	13.6	69.8
Sept.	73.1	11.6	84.7
Oct.	67.4	14.0	80.4
Nov.	72.2	18.1	76.2
Dec.	76.7	16.2	96.9
(1949)			
Jan.	87.0	21.9	68.8
Feb.	80.9	26.5	70.3
Mar.	p93.1	p22.3	p75.3

p—Preliminary figures. Data: NMBTA Index





INDEX	COMPONENTS				
	MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANSPORTATION EQUIP.	OTHER METALWORKING
Mar. 1949 (preliminary) 216	234	212	227	302	148
Feb. 1949 (revised) .. 219	239	224	227	304	150
Mar. 1948 226	251	238	234	289	156

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

tion reports the March total compares to 213,862 in July, 1941, the industry's highest prewar month, but is 37.7% below sales of 408,512 units in March of last year. Factory sales or ironers in March totaled 23,500, down 16.8% from 28,250 in February and a decrease of 56% from 53,686 in March, 1948.

Tool and Die Outlook Fair

"Fair" is the outlook for future business as most tool and die manufacturers see it, with a small segment ranging predictions more optimistically from "good to "excellent." But there is a substantial minority who say that the outlook is pretty bleak. Glimpses of the silver lining stem from the belief that there is good business ahead once customers let loose in order form the jobs which have been planned. In March no new programs developed.

► Tool and die shipments for March picked up 8% over February, but for the first quarter as a whole shipments were off 10% from the corresponding period for 1948. Orders booked in March were on the same level as December and January, and the December 1948 orders were average for the year. February 1949 was one of the worst months, new-order wise, for the tool makers since the end of the war.

Backlog in the industry was down 2% in March from February. The feeling is that it can't get much lower. Many shops have practically no backlog.

March employment leveled off at a little over 25 men per shop. While direct labor man-hours worked were up from February, the gain was less than the increase in working days, indicating an additional shortening of weekly hours.

Inventory Cuts Affect Metals

The policy of manufacturers in general of cutting inventories of raw materials and of components has had a depressing effect upon many metalworking lines. Foundries have suffered; and an outstanding example of what happens at such times is the situation of the non-ferrous metals people.

► Inventories are large enough that many companies can afford to live off their inventories for a month or two if they think prices may drop. That has occurred, particularly among users of copper, zinc and lead. After a series of price cuts, non-ferrous metals are still in relatively slow markets.

The nickel supply is now about equal to demand, with no difficulty in obtaining an adequate supply. No price change is yet apparent.

Zinc is in practically the same situation. Demand has continued to ease and all grades are now readily available. The price has declined from 18½ cents per lb in March to 12½ cents in May.

► The current tin price of $1.03 per lb is causing concern because of feeling that this level cannot be maintained in the face of the recent business decline and the price reductions in other metals. There's a growing opinion that a free tin market should be restored, replacing the previous feeling that the government should continue controls beyond June 30 to provide adequate supplies for industrial users and the stockpile.

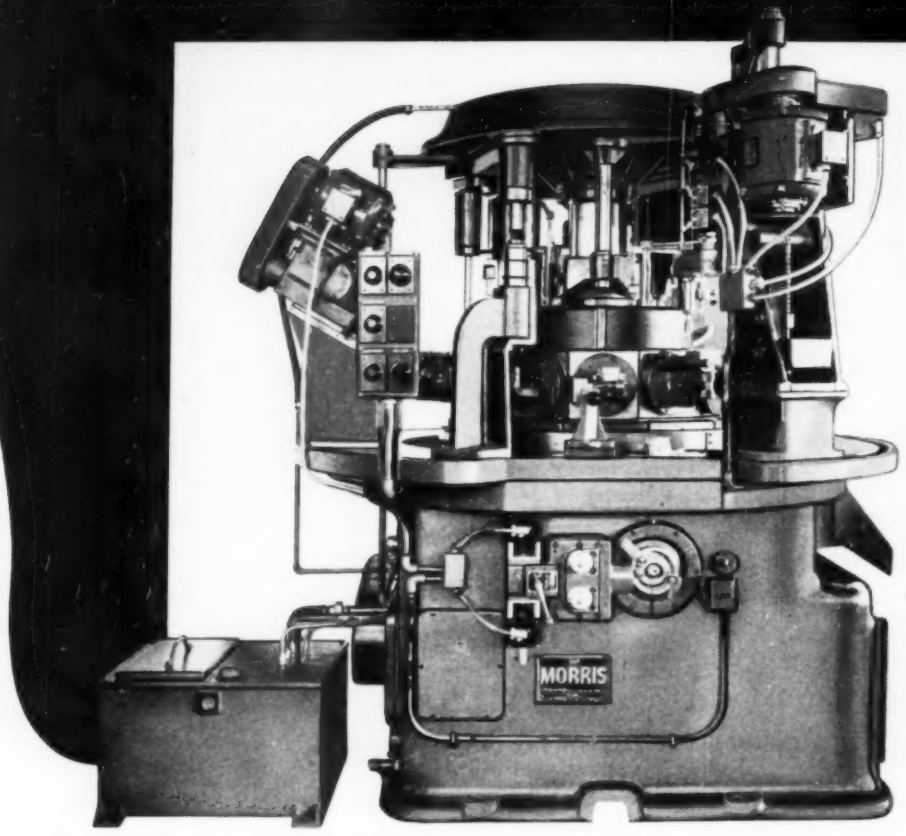
Watch Steel for Trend

The future steel operating rate will be a good barometer of the trend in over-all production. Ingot rate continues at a record height for peacetime. But buyers are less eager to contract for large steel tonnages ahead. They no longer will take all that they can get. Some larger companies particularly are cautioning their purchasing units against accumulation of excess stocks which are subject to obsolescence.

► One of the nation's large steel consumers expects to get all the plates, structurals, bars, wire and even finished sheet it needs for the third quarter. For the first time since reconversion, the company foresees enough sheet from the mills through regular channels to meet its requirements in the third quarter. Conversion deals accordingly are being brought to a close as rapidly as possible.

Production is Automatic on this

MORRIS MOR-SPEED Production Machine



• High production and low costs are essential under prevailing conditions today. To help you meet these conditions at favorable costs Morris has developed a line of Mor-Speed Production Machines.

Each machine is designed to handle a specific job and to obtain maximum production.

For example the Morris center column machine illustrated performs six operations—drilling—reaming—facing—spot facing—chamfering—and tapping simultaneously on automotive carburetor air horns. Thus producing a finished piece at every index of the fixture holding table.

Production is continuous as the twelve fixtures index automatically and operator unloads finished job and loads new piece at each index of the table.

If you are interested in high production and low costs consult Morris—they have the engineering experience and manufacturing "know-how" to design and build equipment to meet your specific job needs.

Write for complete details.

Builders of MOR-SPEED Line

The MORRIS Machine Tool Co.

CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Spending Money To Save Money

"We intend to spend money where we can save money." The president of one of the nation's large manufacturing companies was the speaker.

What he was trying to say was that his company is ready and willing to invest in new plant equipment if proof of its cost-reducing results can be shown.

Here is another bit of evidence that the pressure is on to lower manufacturing costs. Prices of industrial and consumer goods are trending downward. Sales departments again are scratching for business instead of allocating factory output to customers.

As competition takes on added impetus, one of the basic problems of every metalworking company will be to keep its cost of production down to the level of the best in its own industry.

It obviously is impossible to do this if antiquated machinery and obsolete production techniques prevail. There is far more reason to throw out the old in favor of the new now than when a lush seller's market existed.

Many metalworking manufacturers are alert to these facts. They clearly see the danger signal. They know that the sales race will go to those who are fast on their feet and who recognize the need for pricing quality products low enough to tempt cautious buyers.

They are going through their plants, scientifically and painstakingly, searching for the weak spots with an eye to strengthening them. They foresee that money well spent now will pay out handsomely in dividends later on.

They are not stirred to action by a fear complex. The sharpened situation today is rather a challenge to them.

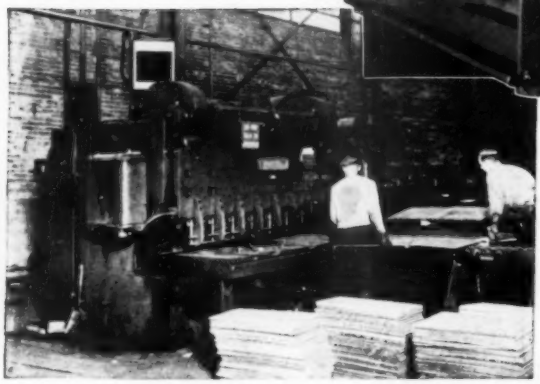
They know that when the going really gets rough, they will be in the best possible spot to maintain their position, or to better it, in a highly competitive market.

They wisely are active supporters of the smart policy of spending money in order to save it.

Burnham Finney

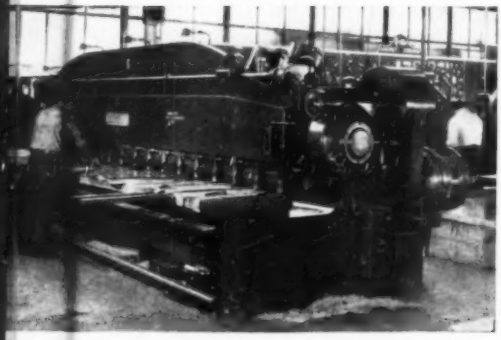
EDITOR

Use a SHEAR



FOR ARMOR PLATE AND ALLOY STEELS

FOR HEAVY PLATE



FOR FERROUS, NON-FERROUS AND NON-METALLIC MATERIAL

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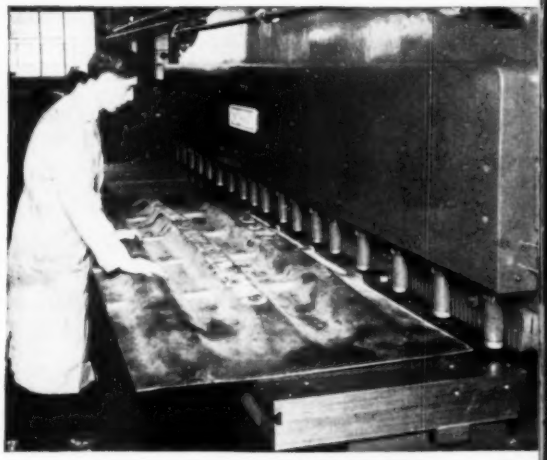
Cincinnati Shears are very profitable machines in many plants in many industries.

You get a "clean-cut" product from Cincinnati Shears.



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How to Choose and Use PORTABLE TOOLS

PART 1...THE ECONOMIC APPROACH

How to establish the actual cost of operating portable tools on the basis of replacement and when contemplating a new installation

BY H. P. BAILEY
President
THE ROTOR TOOL COMPANY

IN METALWORKING plants, many operations are done more cheaply by bringing the tool to the work, rather than the work to the machine. Such operations as grinding, drilling, buffing, sanding, screwdriving and nut setting can be performed with portable tools operated either by air, universal electric, 180-cycle or 360-cycle electric current. These tools are relatively inexpensive, compared to the cost of stationary machine tools, but the labor cost will run from $1.00 to $1.60 per hr. In addition, suitable overhead must be provided, which brings the actual cost of portable tool operations to between $2.00 and $3.50 per hr.

These costs, when multiplied by the productive hours and extended to a year, become a very sizable item and justify a thorough analysis of portable-tool operations. Such an analysis will often cut costs 20 to 50%, or more, and savings are continuous until the operations are changed.

To measure the dollars and cents cost and importance of portable-tool operations and to develop an efficient procedure, facts and figures are necessary. Once the situation is analyzed and the program completed, the figures are again helpful in determining the actual results. Moreover, it must be remembered that the efficiency of the program is 100%, only as long as there are no changes in shop conditions. Since these changes, of course, occur regularly, the facts and figures are again valuable in planning the continual revision of the program which occurs in most shops.

The following method of analysis is suggested to measure the results of portable tool changes and compare them with the costs of the revision of the program.

1. The facts about production time should be figured fairly and accurately.

2. Translate these production facts into dollars and cents to be used as a measuring stick to check the results of the proposed changes. This step must be quite conservative and practical and take into definite account the percentage-of-use of the individual tools.

3. Relate the savings to the cost of the tool itself, so a measuring stick is available to measure the importance of proposed changes.

4. Where substantial changes are considered or complete new installations put in, further financial analyses are helpful in translating the story to the executive level to get the purchase approved.

Figuring Production Time

The first step is to determine the production time savings possible with modifications in equip-

ment. These will usually range between 10 and 50% of the time the tool is in operation. If the saving is less than 10%, it will be difficult to figure and the saving will be small, although perhaps worth while. If the saving is more than 50%, this will probably be caused by unusual situations, which hardly require detailed analysis. The production savings in terms of time must be determined by analysis, and preferably by actual testing, so this figure is fixed beyond question.

Where grinding time is cut 40%, increased production may be figured thus:

Suppose the former time was 10 min; cutting this by 40% reduces it to 6 min. Formerly, the number of pieces per hr would be 60 min divided by 10 min, or 6 pieces. When time is reduced to 6 min, the number of pieces is 10 per hr. As the ratio of 10 to 6 is 1.67, an increase in production of 67% is obtained.

Dollars and Cents Savings

The second step is to compute the cost of an operator on a weekly basis of 40 hr times $2, or $80 a week. This figure, however, should be based on the actual use of the tool.

This factor of use may vary widely, but 50 or 60% is usual. In some operations the figure may drop to 20 or 30%. Particular care must be taken to recognize situations where tool use is 70% or more, as the savings here are bound to be high. Having determined this figure at, say 60%, the cost of operation changes from $80 per week to 60% of $80, or $48 per week.

Comparison of Savings

The third step is to relate the savings to the cost of the tool itself. Portable tools range in price from $55 to $260, the larger figure representing a large drill in a situation where some form of rather expensive tool is necessary to get the job done. If, however, various situations are considered, it will be found that savings of a given percentage of production time will be repaid much faster on the lower price tools than on the more expensive tools, which has a definite bearing on the problem. With a use factor of 60%, and a production saving of 30%, or $14.40 a week, the savings will pay for a $65 tool in 4.5 weeks—that is $65 divided by $14.40. If, however, the cost of the tool is $120, it will take 8.3 weeks; if $180, 12.5 weeks; if $260, 18 weeks. Under practical conditions, it will be found that wherever hand tools are replaced by power tools, usually of a small size, the time of repayment is very short. It may, under exceptional conditions, reach as low a figure as 10 or 15 working days in the case of screwdriving or nut-setting operations. In the case of large specialized tools where savings are not great, it may take as long as a year to pay for the tool, although it may be necessary to buy some type of tool just to get the job done. Attention is directed, however, to the variation in time of repayment as affected by the price of the tool itself.

Figuring New Installations

Where a complete new installation is put in, the investment becomes much larger, because a power supply must also be provided. While it may be true, theoretically, that something will have to be spent to take care of the job to be done, the usual practice among shop men is to total up the cost of the tools and the power supply, total up production savings on all of the tools, and divide to find the time to repay. However, the standard required here of time to repay is much longer than in the case of individual tools. Many complete installations of tools and power-supply equipment are installed because they pay out in from one to two or even three years.

Where the amount involved is substantial, the cash consideration often carries more weight than the element of time to repay, which is very important under today's conditions of high investment requirements. If a set of tools and a power-supply unit of one type can be put in for $3200, while another type costs $6800, often no further consideration is given to detailed figuring in deciding in favor of the less expensive installation.

In the machinery field, purchase of new equipment is often dependent upon the earning power of the investment in the machine itself, that is, the net profit on the average investment involved. This type of analysis is not usually applied in the portable tool field. However, it is evident that in many cases investment in portable tool equipment does produce a very high return on the investment. In ordinary installations, users generally expect to pay for the equipment in one to two years, including the power-supply unit, which obviously is a very high return on the original amount expended. In some cases, executives figure that the power-supply unit, with a life of 10, 15 or 25 years, should be written off over this period and that the return on the investment in the portable tool equipment should be figured by comparing the savings in production time, properly figured, with the cost of the tool equipment itself. Theoretically, in this case, the annual depreciation of the power-supply unit should be deducted from the annual savings.

Establishing a Policy

Once a number of situations have been figured, it becomes quite practicable to set up a shop policy; first, that portable tool equipment in individual cases will be bought only when the earnings will pay for the machine in a given period of time. Second, that additional or replacement installations, including power-supply unit, must be figured by engineering as well as by the factory. Consideration of the facts will direct attention of the operating organization to the possibilities of savings by improving portable tool operations.

The practical problem remains, however, as to just

how to find these opportunities in view of the pressure of work on the foreman and supervisor, and in general, the lack of knowledge of operating personnel of the many forms of tools that are available. The situation requires considerable study on the part of executives, and even of representatives of portable tool builders.

Finding the Opportunities

Offhand walks through the shop are not likely to develop maximum opportunities, and some form of a check list may well be applied to portable tool operations. The following general procedure is suggested as a means of finding opportunities.

First, examine all hand operations to see if any of these can be done by power tools, particularly such operations as filing, burring, small screwdriving and nut setting.

In abrasive operations, check the efficiency, particularly of small grinders, for speed and power. Perhaps the starting point in all grinding operations is to check the wheel used to be sure that it is the right type to do the work and get maximum metal removal. Then work back from the wheel problem to the right machine to drive the wheel, including power and load speed, and include form and shape of machine, handles, etc. While speeds recommended for safety cannot be exceeded, maximum speeds should be applied, and particular attention should be given to the tools themselves to be sure they have sufficient power to operate at high speed under load. It will be found, in most cases, that where the peripheral free speeds do line up with the safety code, it is possible to save money by increasing the speeds under load by providing additional power.

Another point of attack on abrasive machines is to check the various forms of machines, straight spindles, vertical spindles, straight handles, spade handles, front end arrangements, etc. Check the style of the machine for ease of operation.

Starting the Investigation

In many cases, the investigation will start with the percentage of use of the machine to determine the importance of change. Where savings are small in production time but the percentage of use is as high as 50 to 70%, selection of the right tool is usually fully warranted, even with the low savings, and is doubly warranted where the cost of the machine involved is below $100. Where the cost is above $200, it is obvious that a tool must be provided for the job, but care should be exercised to keep the investment low enough to realize savings.

In buffing operations, particularly on stainless metals, a thorough examination of the entire process, the various grades of compounds, speeds, etc., should be made, checking load speeds, and relative efficiency of various types of buffs on different types of work.

In the study of screwdriving and nut-setting problems the investigation may start with the torque required. Where trouble has been experienced in obtaining uniform torque with hand-operated methods, several sizes and types of power drivers should be tried. Where damage to surrounding surfaces is possible, either from too much torque or from the driver head slipping off the screw, various heads may be tried, and the torque determined by trial. Elimination of scrap and rework time brings substantial savings, and other savings can be realized by using self-tapping screws or patented-type nuts or fasteners.

Weld-bead grinding is a typical application for a portable grinder. In this case the straight-handle, air-operated type was found to give twice the production of the original electric tool, with less operator fatigue

With reciprocating tools, such as chipping hammers, the quality of the job may be examined to see that it is up to standard, and then the time element checked. It may prove that the shop has standardized on some one particular chipping hammer, where the conditions call for two or three different types to suit the work. In all these investigations the efficiency of the tools now at work must be checked. Tools that are not repaired or maintained properly will not produce properly. It also follows that where power-supply conditions are inadequate as regards voltage or air pressure, immediate savings can be realized from an attack on this problem.

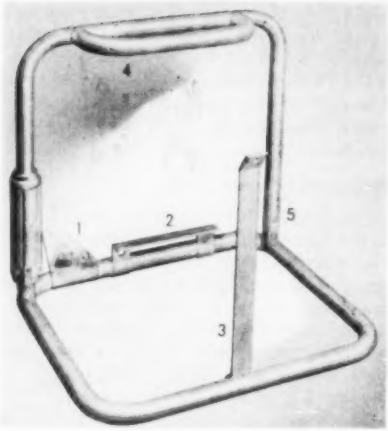
Another element which deserves emphasis, is that some labor costs will be found to be quite high, as in the tool room. It may pay to make changes here that would not be justified in other departments. At the same time, the maintenance angle should be checked to find out what it costs to maintain existing power tools, and to look particularly for those tools which have been superseded by newer designs having more power, more speed, and lower maintenance cost.

(Part 2 of this series will appear in a forthcoming issue.—Ed.)

FIXTURIZED SOLDERING INSURES HANDLE BARS

Shift from purchased welded unit to silver-soldered assembly in plant-made fixtures assures supply, maintains quality and ends plating problems

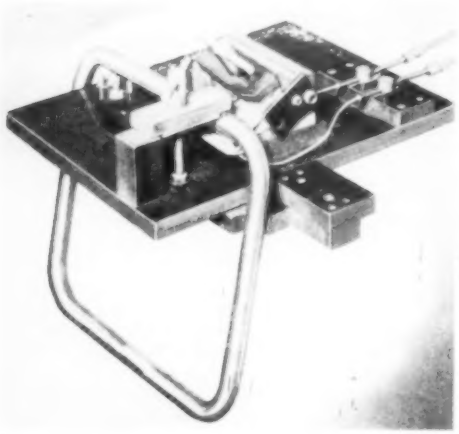
BY JAMES H. KING
GENERAL SUPERINTENDENT, REED-PRENTICE CORPORATION

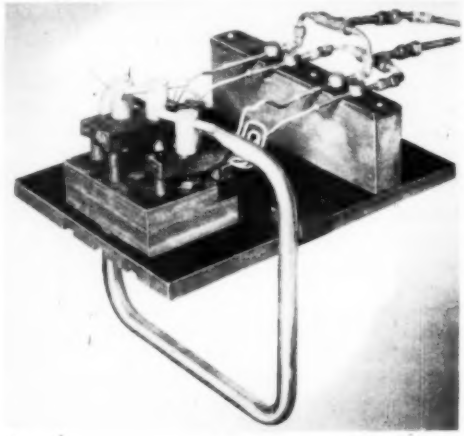


Finished handle bar. Numbers correspond to those on operations shown in succeeding illustrations

INCREASING demand for our gasoline-engine-driven chain saw made it imperative that we step up production. Our outside source for handle bars could not, however, meet our needs as it was; shipments were late and inadequate and many bars contained defective welds which caused leaks during acid treatment before plating.

To avoid production holdups, we began to manufacture our own handle bars. First we changed the design to modify the bends. Minimum-weight requirements demand thin-wall tubing, which promptly collapses when short-radius bends are made. We found it necessary to hold extreme accuracy in fitting the hardened-





1.. STARTER CORD BRACKET

The bracket is located by a pin through the eye and a side bar, held by a sliding thumbscrew clamp. The square is hung over it, positioned for angle by a side notch, and similarly clamped. Heating is done by a pancake coil

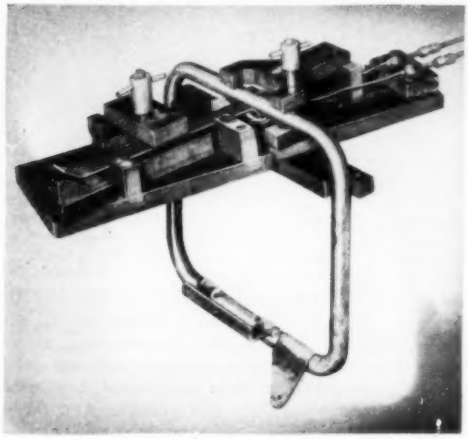
2.. MOUNTING BRACKET

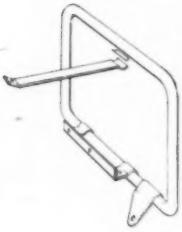
The mounting bracket is set over a block which carries a positioning pin and is held by two screw clamps. The frame goes over it, positioned by a socket at one side and held by a center clamp. Coils are two curved pancakes, in parallel

steel mandrel to the ID of the tube. Bends are made on a Parker Power Bender, and the mandrel pulled by power after forming.

Once bending problems were solved, we shifted to silver soldering. We built special Masonite fixtures for induction-soldering four joints and a steel one for gas-soldering the final assembly. We found it entirely possible to produce, with a 30-kw, 60-amp, 550-volt, Lepel induction heater, and Handy & Harmon Easy-Flo silver solder, joints so strong that an attempt to separate parts ultimately results in tearing out the tube wall instead. Each operation takes less than 1½ min. Preformed solder shapes are used, strip for brackets and supports, wire for tubing.

Handle bars are now produced for stock, ready for assembly as much as four weeks ahead of our increased schedule. Quality is far above that of welded bars, rejects are practically eliminated, and we get a better plating job. No substantial cost savings were made, but we no longer have production holdups because of shortages of these bars and can control output and quality in our own shop.



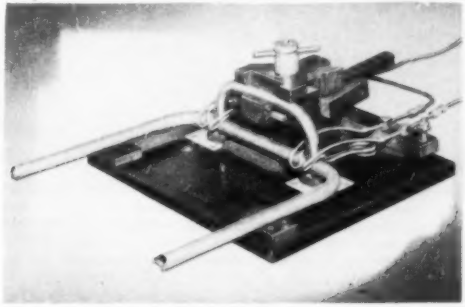


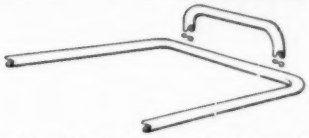
3..LOWER SUPPORT BRACKET

Positioned in a slot and against an end stop, the bracket is held by the usual screw clamp. The frame goes over it, positioned by end notches in a fixture crossbar, and held by a yoke clamp. A curved pancake coil does the heating from below

5.. HANDLE TO FRAME

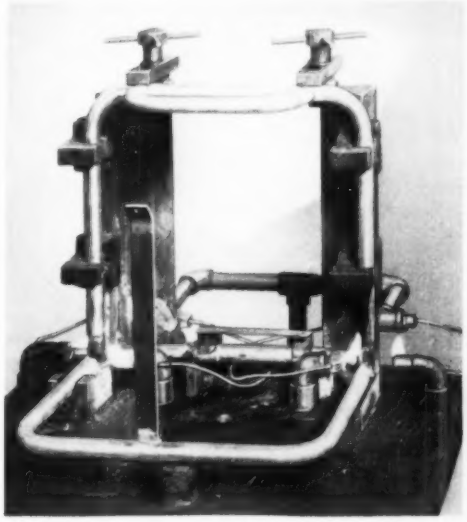
Final assembly involves two joints made at once, again with preformed wire rather than strip. The main frame is set in place on the base and held by the handle, which is positioned by guides and held by twin clamps. Gas heating makes it possible to solder both joints at once





4..HANDLE

Two U sections make this assembly. The larger is positioned in three slots and held down by the smaller, which in turn is held in its positioning trough by a yoke clamp. Here preformed wire solder is used and heating coils are looped to follow the irregular joint



Modern milling, drilling and precision boring machines for finishing WD hydraulic pump bodies are set in a hollow square, with operations proceeding in natural sequence from station to station along lines. Nine machine operators and an inspector readily perform all the operations in this group

QUICK-ACTING FIXTURES SIMPLIFY MACHINING

Operations on pump and valve body castings accelerated; girls handle jobs

BY FRED A. WORLEY, Works Mgr.
West Allis Tractor Works
ALLIS-CHALMERS MFG. CO.

MODERNIZATION of West Allis tractor production departments by Allis-Chalmers Manufacturing Co.'s Tractor Division has resulted in an opportunity to improve tooling setups for a number of different parts. Outstanding example is the new small department for machining cast-iron pump and positioning valve bodies for the hydraulic system of the Model WD agricultural tractors.

Here, modern machine tools and simple quick-acting clamp fixtures have been employed so effectively that nine machine operators are turning out 72 precision-machined pump bodies and a like number of valve bodies per 8-hr day. Operations have been simplified so girls can do the work.

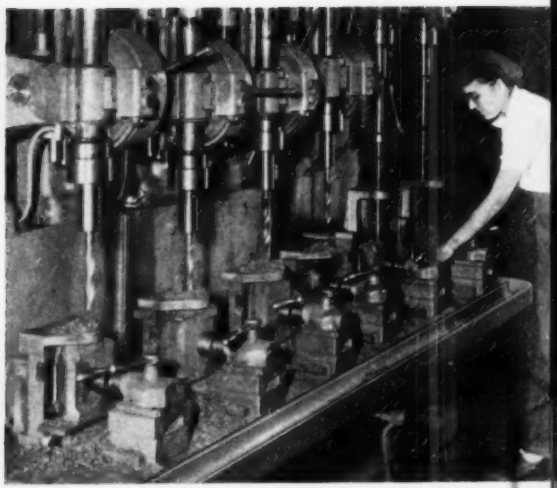
The pump is a four-plunger constant-delivery type of simple design. It has a port-type suction valve, a discharge valve, a set of control valves for regulating, and an unloading valve to prevent the pump from developing excessive pressures. This unloading valve is actuated when pressure in the delivery line reaches 3300 to 3700 psi.

Design of the pump requires close machining tolerances on all surfaces, with the bores of the four plunger cylinders being held within a total tolerance of 0.0002 in. As pump bodies must be transferred to a number of different jigs and fixtures as machining progresses, it is essential that the cast bodies be accurately positioned each time if all milling, drilling, reaming, boring, chamfering and tapping operations are to result in surfaces and holes properly positioned and finished to correct dimensions. For this reason, the second and third operations, following the face milling of the flange surface from which other operations are located, consists of drilling and reaming two 0.380-0.3805-in. locating dowel holes.

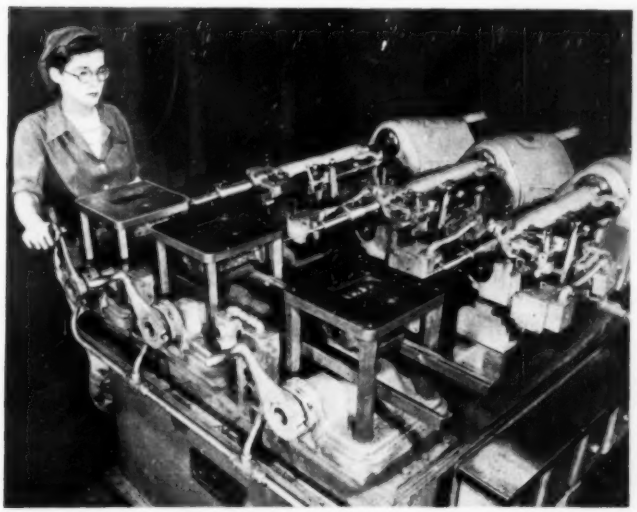
Specifications require that the pump-body castings be free of blow holes, shrink holes and sponginess so the body will not leak under pressure. In addition, specifications call for a hardness range of 160 to 229 Brinell. But this range imposes some tooling problems when finishing to close-tolerance bores for the pump plungers. Toolbit settings satisfactory for castings with lower hardness ratings produce undersize bores in the harder castings, while tools set for harder castings produce oversize bores in the softer castings.

To eliminate checking of bores in each casting, it has been found best to separate incoming castings into three groups. Those below 192 Brinell go into the soft group, those from 192 to 227 go into the hard group, while those harder than 227 are annealed. Job lots of castings delivered to the machines then are selected from one or the other of the two hardness groups and the tool settings are adjusted accordingly.

First drilling operation on pump body follows carbide milling of flange face in a rise-and-fall miller. Two-spindle drillpress has multiple spindle drillheads on each spindle. First spindle drills five flange mounting bolt holes; second spindle reams two 0.380-0.3805-in. locating holes. Up-acting Quick-Clamp fixture slides on machine table, and is located against end stops and back guide rail bolted to machine table. Spring-loaded plate under each drillhead has guide pins to locate in bushed holes in top of fixture



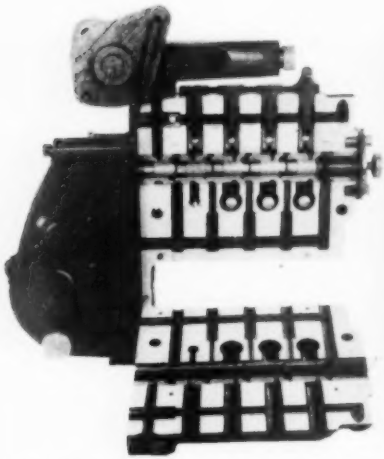
Six-spindle machine drills and single-point bores two 0.907-in. holes, 6½ in. long, through pump body in three steps. First two spindles drill holes to half depth, second two finish the drilling and last two finish entire length of bore with single-point tools. Last two spindle columns have 14-in. raising blocks so boring bars will clear work and allow room for guide bushing supports. Parts are moved from fixture to fixture along line. Each fixture has a universal quick-acting horizontal clamp



Three oil-gallery holes are drilled lengthwise into pump body from one end with this special horizontal drilling machine with spindle assemblies arranged for hydraulic step feeding. Part is slid along rails from fixture to fixture—holes successively are 13/32-in. dia and 5¼ in. deep, ⅜-in. dia and 5¾ in. deep; and 11/32-in. dia and 6 1/16 in. deep. Up-acting Quick-Clamp fixtures raise workpieces from rails against inverted plates where pins enter two locating holes for alignment. Each spindle is equipped with separate drive and controls

Plunger cylinder holes are finish bored in this setup on No. 48A two-spindle Bore-Matic. Three holes are 0.6830-0.6832 in. and one is 0.3125-0.3127 in. Carboloy bits are used and small bar is solid carbide. Machine has automatic cycle, including automatic repositioning of cross-slide to locate each bore

PLEASE TURN PAGE



Cut-away model of WD hydraulic pump shows most of the holes which must be finished to close tolerances in pump body. Precision tooling with accurate part locators solved the problem

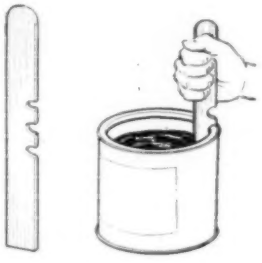
Two-position index table holds two valve bodies in different positions for first and second milling operations with gang of carbide-tipped cutters. Operator loads one side of table while cut proceeds on other side. Parts are finish drilled, reamed, chamfered and tapped in two adjacent three-spindle Allen drillpresses with Magic quick-change chucks

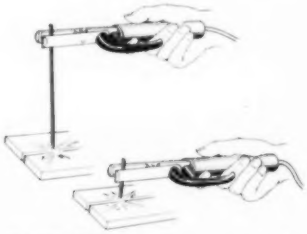
Short Cuts FOR THE SMALL SHOP

BY A. H. WAYCHOFF

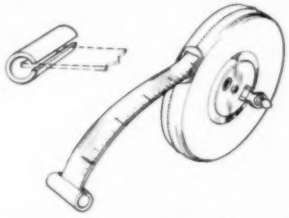
A GLUE-BRUSH CONTAINER is a handy adjunct to the 1-qt. glue can. Take a piece of iron and form it into a double clip that will grip the glue can and a small spice can. Fasten the clamp about the two cans with a machine bolt. When the glue is not in use, it will be kept in fluid, clean condition by the regular cap, and the brush can be put to soak in water in the spice can. In this way the brush is always at hand and in soft, usable condition.

PAINT MIXING is done more thoroughly and rapidly by using a paddle that scrapes pigment from the can inside and throws it toward the center and into the vehicle. An improved paddle with this characteristic is made by cutting notches at intervals, in order to clear the rims on cans of various sizes. In use, the paddle works close to the can wall and bottom corner and avoids the need to scrape pigment out of these sections and attempt to work it into the vehicle after the can is half mixed. Much time can be saved with this paddle.





TACK WELDS in seams can be made more easily with scrap lengths of electrode than with longer lengths, because there is less hand wobble in hitting the seam.

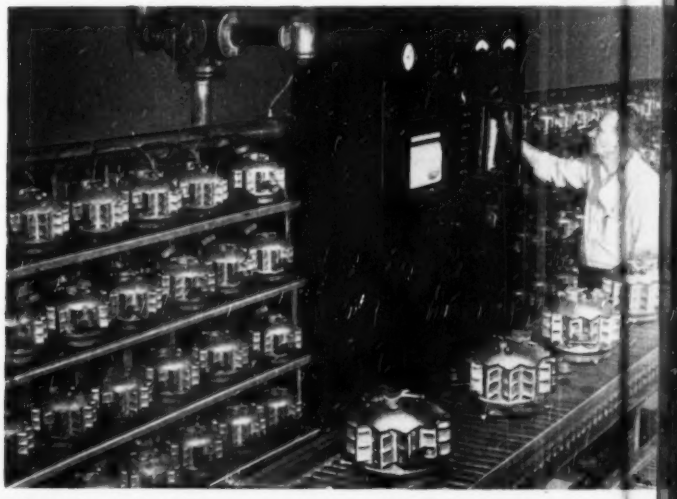


WHEN THE FINGER CLIP on a steel tape pulls loose or is lost, cut a piece of 3/16-in. tubing a little longer than the width of the tape. Split the tubing on one side and close tightly on the tape with a hammer. Now you have a good fingerhold to withdraw the tape and also a satisfactory device to prevent the tape from slipping inside the case.

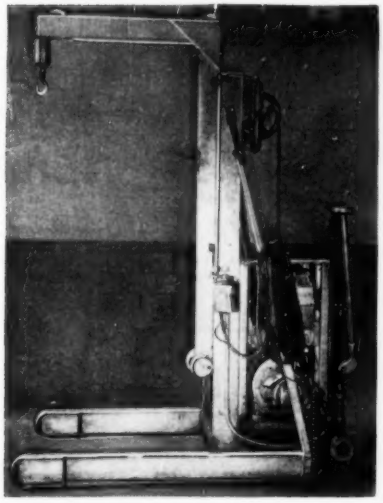
Compressor parts are inspected and assembled in Frigidaire's "Glass House" maintained at 75 to 78 F with constant humidity. Ceiling has 1500 40-w fluorescent tubes on 12-in. centers, giving 40 to 50 ft-c at benches. Dust-proof concrete floors are vacuum cleaned. Precipitrons remove all airborne dust

SHOP SHOTS

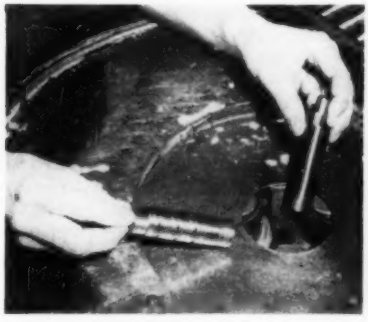
AT FRIGIDAIRE



Dehydration of Meter-Miser compressors is performed by passing current through motor windings to raise temperature internally to 315 F. Units are heated for 1 hr under low vacuum, followed by 3 hr under high (100-micron) vacuum. Process would require 6 hr by oven heating. Racks hold 1656 units when filled to capacity

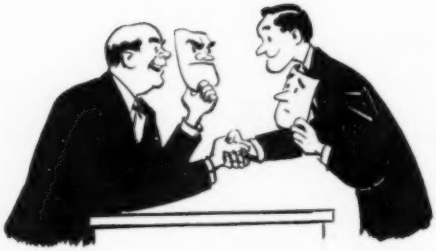


Shop-made power hoist is used in Frigidaire model shop to handle heavy lifting jobs. It is powered by an electric motor that can be plugged in to any convenient 110-v outlet by a long extension cord. Hoist can be moved anywhere in the shop and does away with the problem of battery charging



Helical oil grooves are formed in Frigidaire Meter-Miser compressor crankshafts by a thread-rolling operation on a Reed thread roller. There are 3 turns at $\frac{7}{4}$-in. pitch, and grooves are 1/16 in. deep with a 0.025-in. radius at the bottom. Operation is performed before finish grinding, and production is 600 per hr

Executive Conferences Improve Human Relations



Discussions must be properly conducted and intensely interesting... Here is what must be done for a successful series

BY ALFRED M. COOPER, DESERT CENTER, CALIF.

URGENTLY needed in many organizations are executive conferences on human-factor administration. Ordinarily, executives meet on specific problems dealing with routine and emergency situations, and with the formulation of company policy. These meetings afford no real opportunity for discussing human relations in industry. Such an opportunity may be provided, however, by a series of conferences specifically intended for top-flight executive personnel.

Major objectives in such a series are: (1) to improve the cooperative spirit that exists between the executives who make up the group and, (2) to establish something approximating standard practice throughout the organization in matters pertaining to human relations supervision.

Regarding the first objective, a wide range of conditions may be met in the opening conference. The cooperative spirit may already range from fair to good. On the other hand, there may be present some who have not spoken to one another for years. The discussion leader must gradually break down such barriers, because their existence increases production costs all along the line.

Avoid Areas of Friction

Particularly important is the opening conference. The success of the entire project may well depend upon what happens on the first night. Executives must leave this meeting with a definite feeling of accomplishment, and out of this single meeting there should develop concrete evidence that tension between conflicting personalities has definitely eased. This can be done only when the discussion is confined to subjects that do not recall on-the-job instances of unpleasant friction.

An ideal opener for the series is a "qualities of leadership" discussion. At the start of the meeting, the leader issues to each member a typed slip of paper bearing the following suggestions:

1. The leader has no ideas to present to the group. All decisions will represent the consensus of the group.
2. Everyone is expected to participate in the discussion freely and voluntarily, but no one will be called on for an opinion.
3. Talk one at a time. Please refrain from private conversation out of courtesy to the man who has the floor.
4. Express your opinions briefly.
5. *Any statements made by members of this group in conference are considered confidential and will be treated as such by the leader and the group.*
6. *No group member is committed to any action in his daily duties by an opinion he expresses in conference.*

These last two stipulations are of the utmost importance. It is only when the group members appreciate that they may speak freely on any subject, with no possibility of an unpleasant aftereffect that a proper atmosphere for spontaneous discussion may readily be developed.

Qualities of Leadership

The discussion leader then asks the group to name the various personal qualifications they consider essential in any industrial executive. As the qualities of leadership are enumerated, the leader lists these on a blackboard. About 40 such qualifications will be forthcoming within a matter of minutes, and without actual duplication of sense. These must be numbered in sequence.

By now the group should be properly "loosened up" and in an excellent conference mood. Therefore, it is time to give the members something to think about.

When the list of leadership qualifications is complete, ask the group members to imagine a subordinate they are about to appoint as an assistant, and from the blackboard, list four qualifications that this candidate must possess. These characteristics are to be placed in order of their importance.

Now the real discussion will begin. In support of their selection, executives will talk of actual cases. The leader will concentrate on drawing all group members into an amicable but realistic discussion of the problem. He will permit ample consideration of everyone's views before calling for a show of hands to determine by majority vote the No. 1 qualification for leadership.

When this qualification has been established, the remaining three may be listed in their proper order within a short time. As a rule, the top four qualifications will be among the following: *intelligence, integrity, forcefulness, fairness, loyalty, kindness, knowledge of work,* and *health.*

The actual choice is not important. The discussion leading up to this choice is all-important.

At the close of this initial session, the leader must have succeeded in (a) drawing every group member into the discussion without ever calling on anybody for a response, and (b) definitely improving the relationship existing between certain of the group members.

Crimes in Supervision

In the second conference the leader should employ a change of pace. The discussion in the opening meeting was purposely maintained on a high level of altruism. Now the leader can permit the group to blow off a bit of steam. The title of this second conference is announced as, "Crimes in Supervision."

At the outset, the leaders ask the group to suggest poor practices indulged in by supervisors that would tend to disrupt the morale of the working force. Written on the blackboard as they are named, the list includes: lying, double-crossing, back-biting, short-circuiting, spying, hand-shaking, buck-passing, refusal to cooperate, and a number of other equally vicious actions. On the blackboard, in bold print, these activities appear to be exactly what they are—inexcusable crimes in human-factor supervision.

Next the leader establishes by discussion in order of importance the top three or four crimes in terms of the amount of damage each can do. At the same time, he may find he is leading the liveliest discussion he has ever conducted. In this meeting he will not find it necessary to encourage responses in terms of experience. Rather, he may find it necessary to repress too violent reactions from certain peppery group members.

Reveals Sources of Trouble

Nevertheless, properly conducted, this conference can be the most resultful and valuable of the series. Somewhere among the unpleasant activities listed on the blackboard is the basis (real or imaginary) for any friction that can exist between the executives present. By confining all discussion to hypothetical cases, the leader can permit the group members to air their views, and perhaps even to defend past actions of their own that have been misunderstood and have formed the basis for friction of long standing. Enormous benefit can result from such frank discussions, providing only that the leader keep personalities out of the deliberations.

Prior to the opening of the series and at regular intervals during its life, the leader should consult with the plant general manager. The leaders should make no report on the discussions or the individuals, but should give the general manager an opportunity to express his views. In particular, he may furnish information that will help the leader improve on-the-job relations between individual group members. It is in this manner that a chief executive can best cooperate in the program.

Executive Relationships

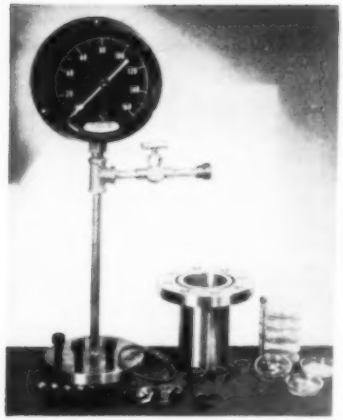
The outstanding distinction between these and conventional foremanship conferences is that the executives in this group ordinarily deal directly only with subordinate supervisors. In the remaining conferences, emphasis must be placed on relationships (1) between executives of equal rank and, (2) between executives and their subordinate heads of departments and sections. The actual subjects to be discussed in the remaining conferences should be agreed upon by the general manager and the discussion leader, after which the leader should formulate questions for discussion. As a rule, these are issued on typed slips of paper as each question is debated. This avoids misunderstanding of the details of the problem.

Among the topics that may be explored are: developing organization, increasing loyalty, improving cooperation, delegating authority, bettering public relations, developing second men, and such other subjects that may appear advisable, depending upon the situation in the particular organization.

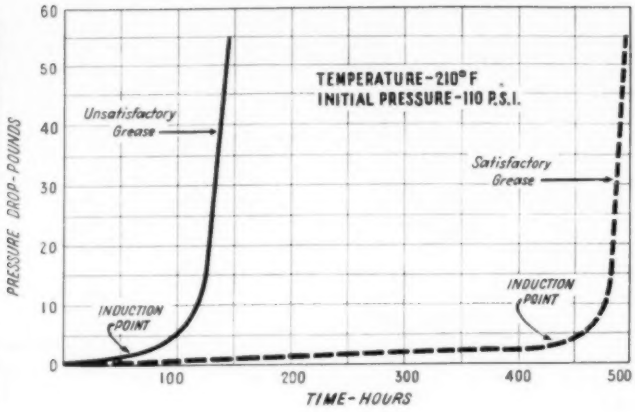
Once the executives appreciate that they can freely express off-the-record opinions in these meetings, the discussions will become increasingly spontaneous and therefore infinitely more resultful. Above everything, however, the leader should avoid referring to the meetings as a "course of instructions." Also, any effort on the part of the leader to "grade" the executives and the quality of their participation would be altogether out of order.

It is desirable that the conference should take place after working hours and away from the plant itself. Ideally, meetings occur weekly or bi-weekly in the private dining room of a local club, with the conference following a good dinner. A better atmosphere exists in these surroundings. Although it may be unwise to announce in advance that any specific number of dinner conferences will be held, the leader should plan upward of twelve meetings.

Successful conferences of this type can be productive of great good for the organization as a whole. Any improvement in methods of administration and particularly in on-the-job cooperation among executives must exert a powerful influence on the quality of human-factor supervision, and hence upon the morale, loyalty, and cooperative spirit of the entire working force of the plant.



Chemical stability of a grease in storage is determined at an accelerated rate by oxygen under pressure in this bomb



Pressure drops in the bomb when oxygen breaks down the grease and chemical changes take place

HOW TO TEST BEARING GREASES

Thorough tests are made of greases for prelubricated ball bearings before their approval. Methods of the Fafnir Bearing Co., described here, can be applied to grease for other applications

THE SKILL expended in manufacturing today's fine ball bearings is of little practical purpose unless such bearings are protected in operation with correspondingly fine lubricants. In the same way, adequate lubrication is vital to everyone in industry concerned with designing, building, and maintenance of machinery and mechanical products of all kinds. Methods followed by a ball-bearing manufacturer, therefore, in the testing of greases before their use is approved (and to insure that their batch-to-batch quality holds up) should be of general application.

The Fafnir Bearing Co. maintains in its chemical laboratory a well-equipped division in which grease testing is carried on constantly with the use of standard and special procedures. A few of the tests are disarmingly simple; others are ingenious and some demand rather elaborate apparatus A grease may be tested here by dry-ice cold or by fire; by beating, whirling, pressure, penetration, or exposure to water. Once a lubricant is approved, tests are repeated to check maintenance of quality.

Types of Soap Greases

Anti-friction bearing greases are petroleum oils (this article does not deal with synthetic lubricants) incorporated in a soap base. Whether the oil is naphthenic (asphalt base) or paraffinic in nature depends upon the general type of service in which the grease is to be used. Paraffinic base oils are generally preferable for bearings because changes in temperatures have less effect on their viscosity.

Numerous soap bases serve as a vehicle for the oil; most important of these as bearing lubricants are:

Sodium soap — either straight sodium-base soap or combination sodium-calcium greases have been generally preferred for ball bearings.

Calcium soap — provides a smooth, water-resistant grease frequently used where wet operation demands it, but possesses too narrow a working range for general ball bearing use.

Lithium soap—excellent greases have been developed with these soaps, which also are water-resistant and smooth. They are affected by bronze, found in some bearing retainers.

Aluminum soap — such soap greases are smooth, almost transparent, highly resistant to heat and possessing great adhesiveness, but not considered desirable for general use in ball bearings. Above 125 F they become stringy and tacky and if cooled too rapidly they may crumble.

As a preliminary to the test of any new grease submitted for Fafnir use, study is made of whatever technical data, chemical make-up information and field history are available. Grease manufacturers,

as well as large grease users, maintain testing facilities and can readily furnish necessary data.

Storage Separation

A basic requirement for ball-bearing lubrication is that there be no excessive separation of the oil from the soap either from standing or in operation. To determine this characteristic, a simple storage bleeding test has been devised. A glass jar of approximately 2-oz capacity, with a mouth about 1¼ in. in dia, is filled with a grease sample. A cone-shaped depression is formed in the grease. It has the same base diameter as the mouth of the jar with its apex located about ¼ in. from the bottom of the jar. The jar is then placed in shelf storage for a month. At the end of this time, bleeding is checked by measurement of the free oil collected in the apex of the conical cavity. It is preferred that there be no bleeding in this test; however, some authorities say that anything under 1% is not objectionable.

Oil Separation At 212 F

Separation is also checked against the requirements of government specifications. In this test a grease sample of approximately 10 grams weight is placed in a 60-mesh cone of about 3-3/32. base diameter which is supported in a suitable mounting over a 100-ml beaker that has been cleaned and weighed. The beaker is placed in a gravity-convection oven where it is maintained at a temperature of 100 C (212 F) for a period of 50 hr. Upon removal at the end of this period, the cone and beaker are cooled in a dessicator and the beaker is weighed. The difference between the initial and the final weights of the beaker is the amount of oil that has separated from the grease. Greases having a separation loss less than 5% are preferred.

Evaporation

The previous test also serves to indicate the loss of oil from the sample by evaporation. The percentage of evaporation is calculated in the following manner:

$$\frac{\left\{\begin{array}{l}\text{Initial wt. of beaker, cone, and grease}\end{array}\right\} - \left\{\begin{array}{l}\text{Final wt. of beaker, cone, and grease}\end{array}\right\}}{\text{Initial wt. of grease sample}} \times 100 = \begin{array}{l}\% \text{ of Evaporation}\end{array}$$

This test indicates the volatization factor of the oil used; the lighter the oil, the more oil lost by evaporation and hence a grease that would tend to harden in service and in storage.

Government specifications limit the evaporation loss to 15% in 50 hours at 212 F.

Dirt Count

The dirt count is a simple test designed to give an approximate idea of the amount (if any) and size of the particles contained in a sample. Upon a thoroughly cleaned porcelain plate, on the surface of which a grid 100 sq cm in area has been ruled, a 0.3-cu in. grease sample is spread. The plate is then covered with a clean sheet of transparent pliofilm and examined under binoculars. The number and size (whether large or small) of dirt particles per square centimeter is recorded and checked against established standards for a commercially clean grease.

Oxidation Bomb Test

This test has been developed to determine the chemical stability of a grease under conditions equivalent to years of shelf storage. It is a static test which subjects grease

Melting point is checked by heating a sample of grease in a cup inside a test tube suspended in hot oil

Torque test for mechanical stability applies agitation (in a bearing) and heat to the grease sample. Behavior of the grease can be watched by the operator

samples to oxidation at an accelerated rate under controlled pressure and temperature. The oxidation resistance of a sample can be evaluated in terms of years based on the induction or breakdown point of the grease:

The apparatus consists essentially of a stainless steel "bomb" fitted with a valve for filling with oxygen under pressure and provided with a gage to indicate the initial pressure and the drop as the grease sample absorbs oxygen while it is suspended in the bomb on a suitable rack. The bomb is held at a constant temperature in an oil bath during the test. For convenience, this bath is large enough to hold several bombs thus permitting the testing of a number of greases at one time.

Breakdown of the readily oxidizable constituents in a grease occurs in two stages. The first is termed the induction period during which the reaction rate, as indicated by the pressure drop, is comparatively slow and only slight chemical change takes place. After a time, the second stage begins, at which there is a sharp rise in the pressure loss curve indicating that more rapid chemical change is under way. When this point is reached, the induction period is at an end. The length of time involved in the induction period is indicative of the chemical stability of the sample under test.

A good ball-bearing grease will show no noticeable change in color, consistency, or appearance until the end of an induction period which has been fixed as the minimum.

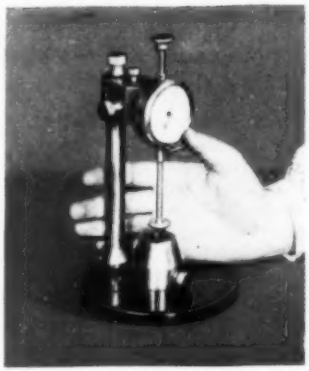
The following definite correlation has been found to exist between induction periods and safe shelf-storage life:

Induction Period	*Safe Shelf Life*
50 hr	Less than 1 yr
150 "	2 to 3 yrs
500 "	More than 4 yrs

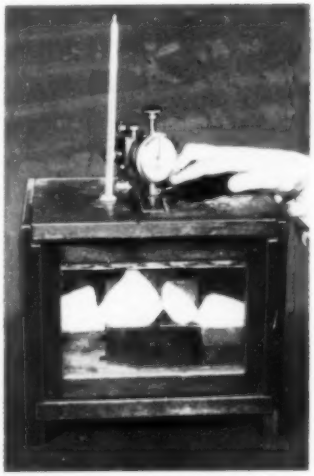
Only greases possessing high resistance to oxidation as measured by this test are suitable for use in prelubricated bearings.

Melting Point

The melting point test adopted as standard by the Annular Bearing Engineers Committee (ABEC) is a slight modification of the ASTM drop-point test for lubricating greases.



Miniature penetrometer measures the depth that a cone sinks into grease sample to indicate consistency



Consistency at —15 F is tested with a miniature penetrometer mounted inside a cold box

The apparatus for this test is a metal cup with a small hole in the bottom, suspended in a test tube which, in turn, is immersed in a heated bath of transparent oil. A sample of the grease to be tested is spread on the inside walls of the cup and a thermometer is placed in the test tube with its bulb just clearing the hole in the cup. Heat is applied to the oil bath at a fairly rapid rate until the thermometer registers approximately 20 F below the anticipated melting point of the sample. When this point is reached, the heating is continued at a slower rate and careful observation is made of the temperature at which the first drop of grease falls through the hole in the cup to the bottom of the test tube. This temperature is taken as the melting point of the grease. The melting point test is run for comparative purposes only and does not give the safe working range of the grease. In general, a melting point of around 325 F indicates a grease that will give wide working range in ball bearings.

Corrosion Test

The copper strip corrosion test is a quick, simple, and easily comprehended procedure to determine whether or not a grease will corrode metals. This is the standard test used by the ASTM and all government agencies concerned with the specification of lubricating greases. Freshly polished copper strips are spread with a thin film of the sample. Some of the coated strips are set aside at room temperature for a period of 48 hr and others are placed in a temperature of 160 F for 24 hr. After these exposures, the strips are cleaned with petroleum ether and compared with a newly polished strip. Any noticeable stain is cause for rejection of the grease causing it.

Consistency

Consistency may be defined as a measure of the resistance of a grease to permanent change in shape, or in other words, consistency is a numerical measure of the relative hardness of a grease.

Since many greases are now "milled" or "worked" by the maker, the term "unworked consistency" means the condition of the grease before it has been subjected to the action of a ball bearing. Conversely, the worked consistency is the condition of the grease after it has been subjected to the action of a rotating ball bearing or other device.

The consistency of a grease in an unworked condition is determined by measurement of the depth to which a cone of known

weight and shape will penetrate the grease in 5 sec at a temperature of 77 F accurately held to within plus or minus 3 F.

The instrument for making the unworked consistency test is the miniature penetrometer developed by the ABEC for use with the ABEC mechanical stability tester. A grease sample, as received from the manufacturer, is placed in the cup and leveled off. The point of the cone is placed on the surface of the grease and the indicator dial set at zero. As the cone sinks into the grease, the depth of its penetration is measured directly on the indicator. A reading is taken and translated from a table into a penetration number for the grease sample.

Most greases change in consistency tending to become softer when put to work in a ball bearing; some to a much greater extent than others. A quick method of checking this tendency is to work the grease, check the penetration after working and then compare it with its original, unworked value. The worked consistency of an acceptable grease should range, for example, between that of vaseline and library paste.

Cold Test

The purpose of this test is to determine whether a grease will be plastic at low temperatures. The apparatus consists of a cold box equipped with a thermometer and an ABEC miniature penetrometer. The cup of the penetrometer is filled slightly over level with the grease to be tested and placed in the cold box at −15 F for a period of 20 to 25 min. The cup is then placed in the cupholder and the point of the cone set just even with the top of the grease. At the end of 5 min, the penetration is checked. At least two separate tests are run on each sample and the results averaged.

One of the most critical factors to be considered in the selection of a grease is the temperature range over which it will function. A good grease will not harden at −32, and conversely, will not thin down at temperatures approaching 200 F.

ABEC Torque Test

This test permits visual observation of the behavior of greases in actual operation in a ball bearing under predetermined conditions of speed, time, and temperature. The machine used for the test, developed by ABEC, incorporates a fractional-horsepower motor attached directly to a shaft carrying a 204 Conrad grease-shield bearing. (A Conrad bearing is one with deep grooves and uninterrupted raceways with a ball separator. Size 204 is a single-row, radial bearing with 20 mm bore and 7 balls.) This bearing is inclosed in an oil-jacketed housing heated by a gas flame, permitting the study of grease behavior over a wide temperature range up to a maximum of 300 F.

The test, involving both agitation and heat, will alter the nature of many greases and cause them to separate, thin down, and become fibrous. These conditions are undesirable in ball bearings and the ABEC machine can screen out greases possessing these qualities.

Low-Temperature Torque Test

The object of the low-temperature torque testing of ball-bearing greases is to determine the amount of hardening or increase in resistance to rotation induced by low temperatures. To insure reproducibility of results in various laboratories, the apparatus is standardized from designs approved by both the ABEC and the National Lubricating Grease Institute (as is the case with the Oxidation Bomb Test). It consists of a cold box and a spindle assembly incorporating a 204 Conrad bearing to which the grease is applied.

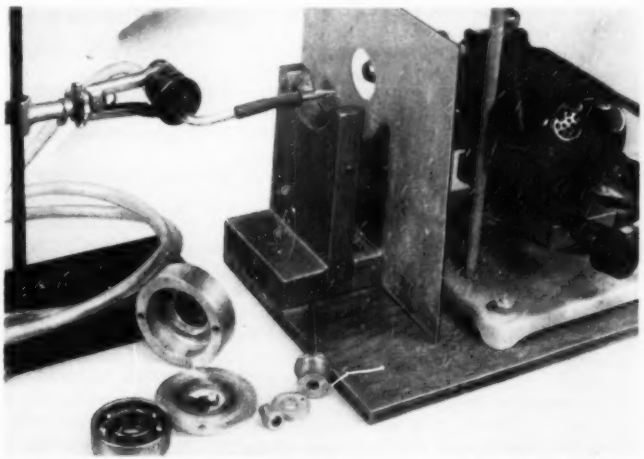
The box temperature is held at a fixed low temperature for a certain length of time. The time necessary for one complete revolution of the spindle upon application of a specified torque is then recorded. After a lapse of 15 min the torque is applied in the opposite direction and the time for a complete revolution is again determined.

Water Resistance

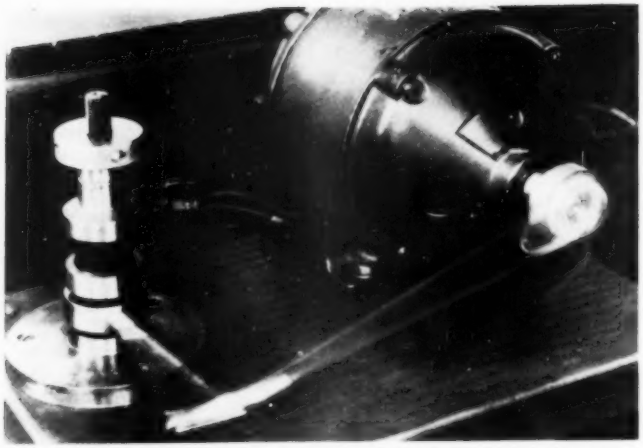
Greases for wet application should be resistant to the solvent action of water. If they are not, they will wash out of the bearings.

There are two tests for water resistance—the standard ABEC test and the joint Army-Navy test. The ABEC test consists of spreading a thin film of the sample on a clean porcelain plate and placing on it several drops of distilled water containing 5% of a 1% alcoholic phenolpthalein solution. If, after 15 min, no alkaline reaction occurs, the grease is considered water resistant.

The AN test requires more elab-



Water resistance can be checked by a water spray on an operating bearing containing a measured amount of grease



Friction oxidation is measured by oscillating thrust bearings under thrust load, then measuring wear loss on washers

orate equipment. In this test, a 204 Conrad bearing is weighed, packed with 4 grams of grease and then mounted on the horizontal shaft of a motor in a special metal housing. There is a small clearance between the inner ring of the bearing and the faceplate of the housing and a 1/32-in. clearance between this plate and the smaller plate which clamps on the motor shaft. A stream of water, flowing through a 1-mm nozzle at the rate of 30 ml per minute is impinged against the faceplate of the housing ¼ in. above the 1/32-in opening.

The bearing is revolved at 600 rpm for one hour, removed, dried out, and reweighed to determine the grease loss. The difference between the initial and the final weights, divided by the original weight of the grease, is expressed in percentage; if the loss is less than 50% the grease is approved as water resistant.

Qualitative Analysis of Soap Content

It is desirable in testing a grease to determine the character of its soap base. This qualitative analysis is performed in the following manner:

A sample of approximately 3 g weight is placed in a porcelain crucible and heated over a low flame until the grease is burned out. Heating is then continued for about 30 sec. The residue in the crucible is cooled and water added. A portion of the water is poured off into a test tube and checked for alkalinity by the addition of a few drops of phenolpthalein:

(1) Strong alkalinity indicates sodium.

(2) Slight alkalinity indicates calcium or lithium.

(3) No alkalinity indicates aluminum.

Following this procedure, hydrochloric acid is added to the remainder of the water in the crucible. The resulting solution is flame tested by dipping a platinum wire into it and then inserting the wire in the flame of a bunsen burner:

(1) A yellow flame indicates sodium.

(2) A brick red flame indicates calcium.

(3) A carmine flame indicates lithium.

(4) A green flame indicates barium.

The brick red and carmine colors may be seen more clearly through a blue glass filter which screens out the yellow of any sodium present in the flame.

Upon completion of the flame test, the solution remaining in the cruicible is filtered, made alkaline by the addition of ammonium hydroxide, and heated. The formation of white, gelatinous precipitate indicates aluminum. The liquid is again filtered and sodium carbonate solution added. The formation of a white precipiate indicates calcium.

Friction Oxidation

This test was devised as an aid in selecting those lubricants which would most satisfactorily prevent rapid wear in a ball bearing subjected to oscillating motion only. This wear causes small pockets to form under the balls in the raceways, wears the balls out-of-round and also tends to wear the cage pockets.

The apparatus used was designed and built by Fafnir. Briefly, this apparatus consists of a base supporting a vertical stationary shaft on which a collar containing two small ball thrust bearings is oscillated by means of a connecting rod operated by an electric motor. A load is imposed on the balls and washers by means of a calibrated spring held in compression by threaded collars screwed onto the vertical shaft. Before assembly, the washers are carefully cleaned and accurately weighed and a sample of the grease to be tested is applied to them.

The machine is then set in motion so bearings are oscillated for a period of 50 hr. They are then dismantled and again cleaned and weighed. The difference between the initial and the final weights indicates the amount of wear which is the index of the lubricating quality and/or friction oxidation resistance of the grease. A new set of thrust bearings is used with each test.

Failure of a grease to show up well in this test does not necessarily mean that it has little lubricating value for, under certain conditions, it may be very satisfactory.

Generally, the wear that is recorded averages less than 0.0002 g. On greases with other needed qualities, we must accept higher values than this in order to obtain specific performance.

A ball-bearing company, or any other company whose product's operating life depends so heavily on the quality of its lubricant, cannot afford less than the best lubricant—cannot afford to neglect any available means of finding the best and determining constantly that it reamins the best.

Metal Spraying

WHAT IT IS . . . WHAT IT DOES . . . HOW IT IS DONE

BY MILES J. ROWAN, ASSOCIATE EDITOR

METAL-SPRAYING guns have been aptly described as "putting-on" tools. With them any metal that can be melted in the oxy-acetylene flame can be applied to any material that can be prepared to receive a coating.

Versatile and fast, metal spraying has won its place in the field of maintenance. Cost-reducing applications in this service are creating increasing interest in its possibilities as a production process. Furthermore, industrial research has uncovered new metals and has developed new techniques that have considerably extended the field of usefulness for sprayed coatings. Yet, though its potential is great, metal-spraying is no "cure-all." It has definite limitations and these must be thoroughly understood if mis-applications are to be avoided. Equally important is a knowledge of proper operating procedures in applying coatings.

Discussed herein is the nature of sprayed metal and the conditions under which it may reasonably be expected to give good service, the equipment needed for the process, and the steps required to produce good coatings.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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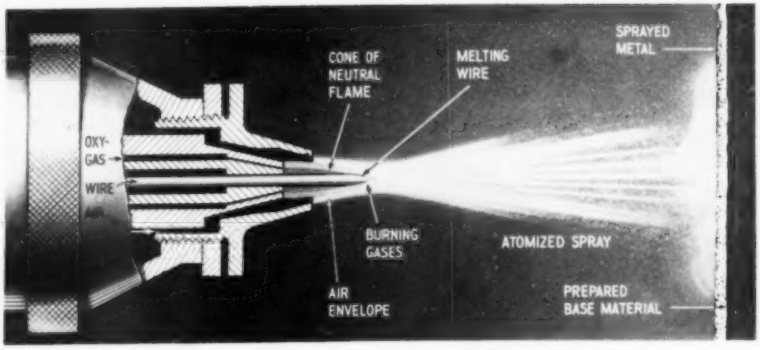


Principle of spraying metal by the wire process is to melt wire continuously in a gas-oxygen flame and to project molten particles at high velocity against a prepared surface. A stream of compressed air surrounding the flame provides the impelling force. In another process, the same principle is applied to spray metal that enters the flame in powder form

What Is Sprayed Metal?

METAL spraying consists of melting metal, atomizing it, and projecting the globules of molten metal against a surface that has been prepared to receive the coating. Globules flatten as they strike, forming a thin, porous layer that enters the irregularities of the surface and mechanically locks itself to the base metal. The resultant coating is a new material with properties considerably different from those of the metal from which it came.

Of the total characteristics of this new material the following are of major interest: the properties of the particles that make up the coating, the cohesion between the particles, and the porosity of the coating. These factors, plus the strength of the bond between the coating and the base metal, largely determine the suitability of sprayed metal for any given application.

Once the application is decided, the strength of the bond is probably the most important single factor in the success of metal-sprayed coatings. A good bond, in turn, depends upon proper surface preparation and correct spraying technique.

It is important to note that sprayed metal is not a material for general fabrication. It should not, for example, be used to join two pieces of metal. It should be applied only as a coating for specific purposes on materials that have the inherent strength for the application.

Sprayed metal has two major applications: as a wearing surface on machine elements, especially those needing good lubrication, and as a coating to protect iron, steel, and some other base metals against corrosion. Many jobs have been done in maintenance, but the process is also adapted to production work.

Applications are found in many other fields including, ornamentation, electro-forming, hard-facing, and electrical units. In addition, some equipment will spray plastics.

Where to Use Sprayed Coatings

What Holds Sprayed Coatings Together

Present thought is that particles are bonded by a combination of mechanical interlock and oxide cementation. During projection, the globules of molten metal are covered with a thin film of oxide. Upon striking, the globules flatten, increasing their surface area and rupturing the oxide film. This exposes pure metal which firmly adheres to the thin oxide already formed on the particle that has just struck. Thus, although present knowledge on the subject is not complete, it is felt that oxide cementation plus physical interlock play the major roles in the attachment of particles to one another.

Machine-Element Work

METAL SPRAYING is most widely applied in building up worn areas on machine elements. And the metal most commonly sprayed for such work is steel.

With steels, spraying increases the particle hardness. Further, sprayed coatings are porous, and this porosity enables them to absorb oil and readily maintain an oil film. These two characteristics—particle hardness and lubricating qualities—combine to make sprayed metal an excellent material for wear and abrasion resistance.

Applications that involve rolling action, such as ball-bearing races or railroad wheel rims, must be avoided. Such applications tend to elongate the coating and the cohesion between the particles is not strong enough to stand up under this action.

Likewise, the strength of the bond between the coating and the base is not sufficiently high to withstand sharp impact over a small area. Thus, gear

teeth and parts subject to shock must not be coated.

Other work that should not be attempted includes jobs on which the coating is subject to direct shear. Threads, for example, should never be cut in a sprayed coating.

Steel for spraying can be obtained in a variety of compositions that offer a wide range in such properties as machinability, wear resistance, and finishing characteristics. Selection depends upon the service expected from the coating.

If corrosion resistance is desired, stainless steel, nickel, or monel may be the choice. To be effective these coatings must be impervious. Coatings 0.025 in. and over generally are impervious because of a labyrinth seal effect. Others may be sealed with a solution either of tung or linseed oil mixed with 5% by volume of cobalt liquid drier.

Steps in Reclamation

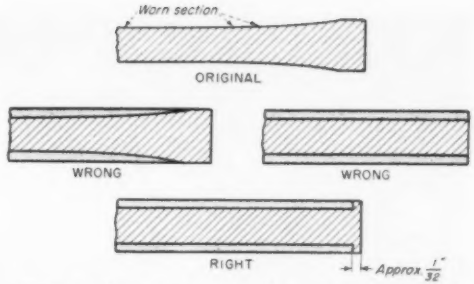
Actual steps in reclamation are four. First, parts are machined undersize at the worn areas, either by turning or grinding. The purpose is not only to clean up the worn sections, but also to provide space for the coating. The minimum depth of undercut depends upon the diameter of the part and the wear expected. It is generally recommended that the shoulder of the undersize section be undercut to permit dovetailing the coating into the part.

The next step is to roughen the machined surface. The coating then is applied, and finally the sprayed metal is machined to finished size.

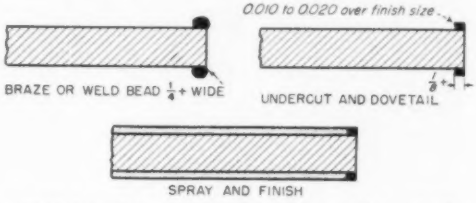
Corrosion-Resistant Coatings

The second major field for metal-sprayed coatings is protection of a base metal against corrosion. Before starting any job, careful consideration must be given to the type and severity of corrosion, to the selection of a suitable metal, to the thickness of coating required, and to the conditions under which the coating will function.

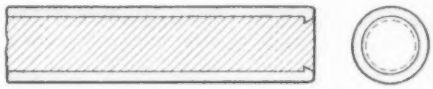
Iron and steel are the metals most often protected by metal spraying. Aluminum, cadmium, and zinc are anodic to these metals and will protect them electrochemically. Under attack, anodic metals protect by being themselves attacked. They also form a film of corrosion products that seals the base



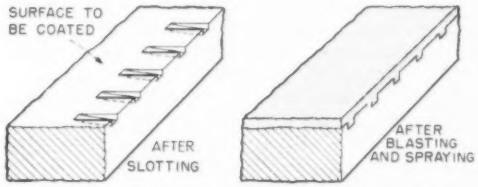
Shaft coatings must not be tapered or unsupported



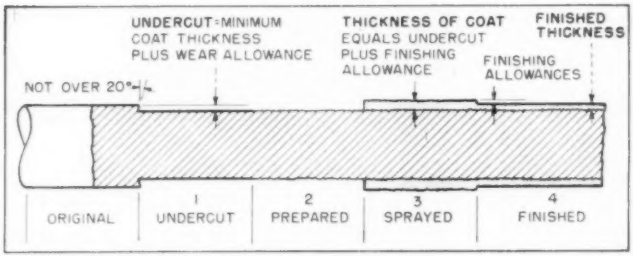
Welded bead is required when worn section extends to end and operates against pressure as in pumps

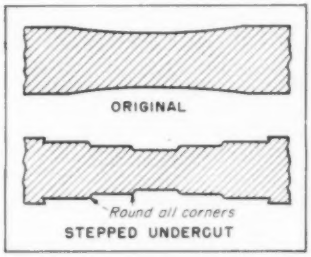


End dovetailing is recommended when worn section extends to end of shaft. Corners should be rounded

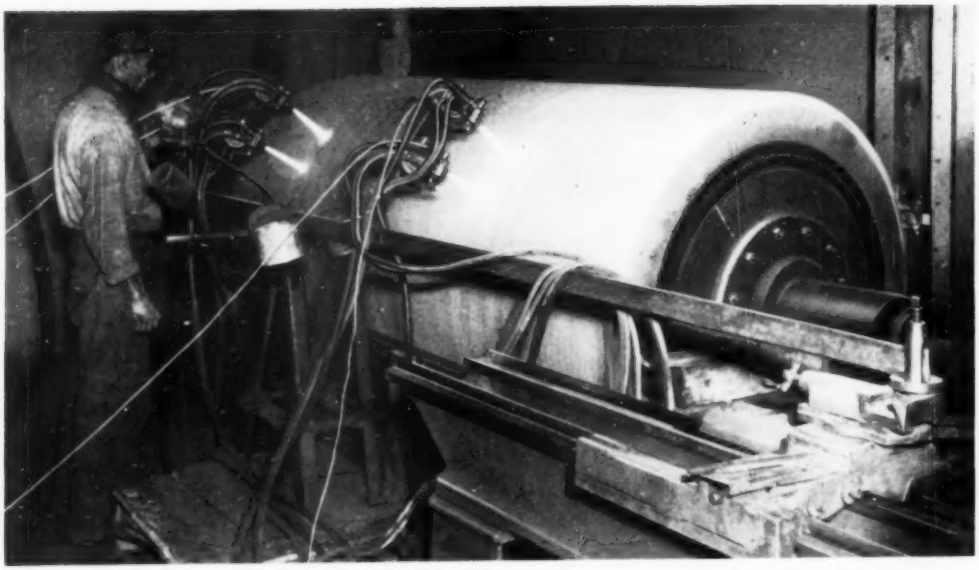


Flat surfaces can be slotted with saw blade 0.080 to 0.090 in. wide. Slots are about ½ in. long and not over 1/16 in. deep. Spacing varies from ¼ to 2 in. depending on thickness of coating and bond strength desired





Shaft reclamation requires four steps. These are illustrated in sequence from left to right. Worn section is machined or ground undersize (1). Entire undercut is cleaned and roughened (2), then sprayed oversize (3). Coating is machined or ground to finished size (4). Stepped undercut saves expense on heavily worn shafts



Large roll was sprayed with 670 lb of pure nickel, then ground and polished. Original surface was prepared by grit blasting, with added anchorage provided by pneumatic chisel notching and by electric bonding on the edges and center sections. Roll is 10 ft long, has a 48-in. dia, and weighs over 8000 lb

metal from the corrosive influence. The porosity of the coating has little or no bearing on its effectiveness and coatings giving complete protection are easily obtained.

It is essential, however, that the limitations of these coatings be recognized. Protection may be obtained against atmospheric conditions, fresh water, salt water, and mild acids no stronger than acetic. The coatings will not stand up against strong acids, and the presence of a dissimilar metal in a lined container, such as a copper coil in a zinc-lined cold-water tank, will set up electrolytic action that will cause deterioration of the lining.

Cadmium, because of its high cost, is seldom selected, but aluminum and zinc are widely applied. In the "as-sprayed" state, the service life of both zinc and aluminum is proportional to thickness and to the severity of the conditions. Although thickness as low as 0.001 in. for zinc and 0.003 in. for aluminum will protect iron or steel in mild atmospheres, coatings may run as high as 0.012 or 0.015 in. for long life under severe conditions.

Under paint, coatings seldom exceed 0.004 to 0.006 in. No surface preparation is required prior to painting and most paints are satisfactory except those with a red lead or a bitumen base.

Other metals are cathodic to iron and steel and will protect them only if completely impervious. This requires coatings at least 0.025 to 0.030 in. thick. Except with tin and lead it is not practical, because of cost, to spray such heavy coatings over large areas. Thus, the porosity of sprayed metal virtually excludes metals cathodic to iron and steel as protective coatings for these materials. The same is true of sprayed coatings of any metal cathodic to a given base metal, if protection is the only purpose of the coating.

In the food and chemical industries lead and tin in the sprayed state have been selected to protect against mild conditions. The porosity of these metals can be reduced by scratch brushing or light shot peening, and coatings can be made impervious at thicknesses as low as 0.012 to 0.015 in.

Non-magnetic coatings on iron and steel can be checked with an electric thickness gage.

In the field of protective coatings, metal spraying often is competing with well-established methods, such as hot-dip galvanizing and electroplating. In such cases, metal spraying's greatest usefulness lies in two spheres: (1) jobs that cannot readily be han-

GALVANIC SERIES

REACTION	METAL	
ANODIC	Aluminum	Metals are listed according to their relative tendency to corrode galvanically. When two metals are joined, the one higher on the list corrodes first. Series is the basis for corrosion-resistant coatings.
	Zinc	
	Cadmium	
	Iron	
	Nickel	
	Tin	
	Lead	
	Bronzes	
	Copper	
CATHODIC	Silver	

dled through these processes or that are subject to distortion from heat, and (2) jobs that can be mechanized and put on a mass-production basis.

General Applications

Metal spraying is often employed to repair castings which have blow holes or surface defects. Deposits add no strength, simply improve appearance.

A recent development is the spraying of hard-facing alloys. Coatings are sprayed on prepared surfaces with either a wire or powder pistol and then are fused by oxy-acetylene flame, induction heating, or controlled-atmosphere furnace. The result is a dense, non-porous layer that is welded to the base metal. Coatings can be applied to all steels, stainless steels, some cast irons, and some copper alloys.

The process depends upon special alloys composed primarily of nickel, chrome, and boron. When brought to the required temperature (1850 to 2050 F), the coating becomes plastic, instead of melting sharply, and bonds to the base metal without flowing or losing shape.

Coatings over 0.060 in. are not recommended, and, in determining finished thickness, an allowance of 20% must be made for shrinkage. To prevent cracking, coatings must cool slowly and should not be applied to metals with a low coefficient of thermal expansion. Caution should be exercised to avoid applications on which the fusing heat will cause warpage that will affect the functioning of the product. Grinding is the most satisfactory method of finishing.

Heat Protection

For protection against high temperatures, iron and steel parts can be given thin coatings of sprayed aluminum. Surfaces are prepared by grit blasting, sprayed with aluminum, sealed with a special solution, and heat-treated. Resultant coatings will give good service up to 1800 F. Applications include such articles as furnace parts, heat-treating pots, and pyrometer tubes.

Other proprietary processes employ a special chrome-nickel alloy beneath the aluminum and omit the heat-treating step.

Copper and its alloys are sometimes sprayed as decorative coatings. For outdoor applications, coatings must be heavy to be imprevious or, for thin coatings, the base can be given a flash undercoat of aluminum approximately 0.003 in. thick. In the electrical field, sprayed copper has several applications involving provision of good electrical contact.

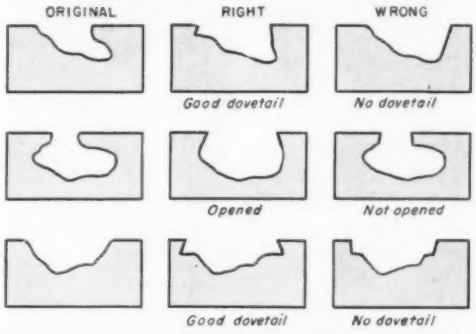
By first coating with a thin film of aluminum and then copper, glass surfaces can be soldered under low pressure in a low temperature furnace.

An interesting procedure is the spraying of very low-melting-point alloys (as low as 117 F) to produce cores for electroforming. Objects that are free of undercuts are sprayed to produce a shell that is a negative reproduction of the part. This is coated with a parting medium and sprayed again to give a positive, on which the electroforming may be done. After the plating is complete, the alloy readily is melted, leaving the desired piece.

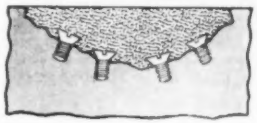
Shrinkage characteristics of these alloys are such that excellent reproduction is possible. Detail as fine as 5000 lines per inch can be duplicated.

In the plastics field the same group of alloys are

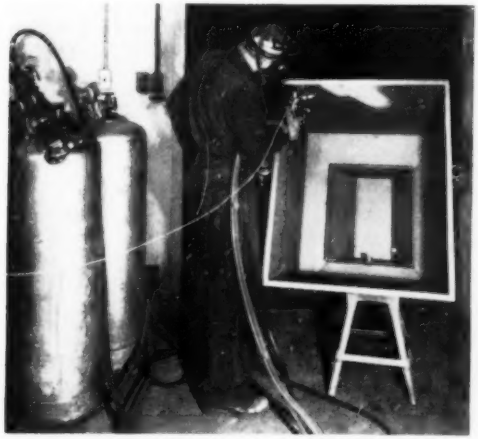
Cracks in castings should be opened and dovetailed before surface preparation and spraying



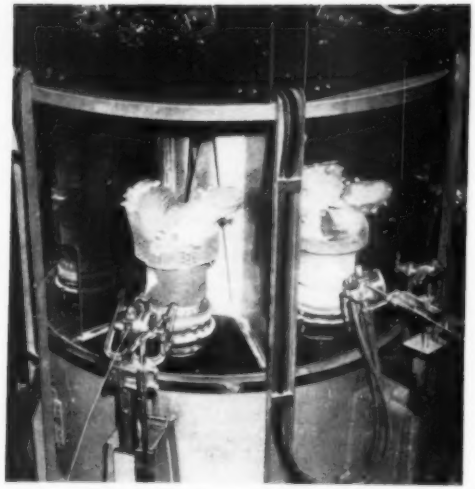
Blowholes should be opened so spray can fill completely without bridging recessed areas. Edges are undercut for a good dovetail



Flat-head screws provide added anchorage where heavy deposits are required



Corrosion-resistant coating is applied by holding gun in hand. As a safety precaution, operator wears mask giving complete respiratory protection.



Automatic machine sprays pure aluminum on aircraft engine cylinders as protection against atmospheric corrosion. Blasted parts are delivered by roller conveyor. Guns are set at proper angle to coat deep fins and complex shapes. Cylinders rotate and guns reciprocate in timed relationship

sprayed over models of plaster, wax or clay, in the making of low-cost molds for specific applications. Stencils for painting intricate shapes are also made by spraying directly on the object. For greater durability and ease in cleaning, the stencils of sprayed metal are put through the electroforming steps to produce a copper stencil, which is then polished.

Spraying Plastics

Although metal spraying is the subject of this report, mention should be made of spraying plastics, for the operation is performed with the same pistol that is used for the spraying of powdered metal.

Plastic coatings may be sprayed as tank liners to protect any base metal against corrosive action, either acidic or alkaline. For this purpose, polythene powders are available in several compositions that provide a range in properties such as resistance to chemical action, ease of application, and adhesion.

A −40 mesh powder is usually satisfactory. Powders are heated but not actually melted in the pistol flame. The heat of the flame passing over the powder after deposition plus the heat of the object being coated combine to melt the particles into a continuous, non-porous coating. Surfaces are prepared by grit blasting.

Linings must be impervious, but will protect in thicknesses as low as 0.005 in. and are not subject to deterioration. They may be applied in place of lead, rubber, or plastic sheet on intricate shapes on which sheet is difficult to apply.

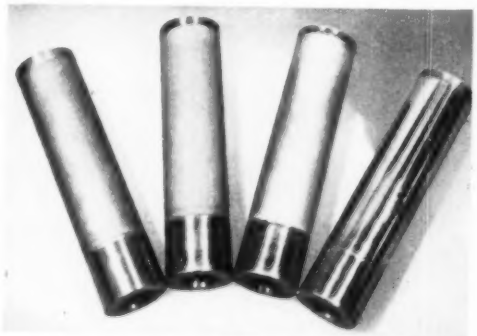
Synthetic rubber is also sprayed in powder form, with the majority of applications being on rudders, shafts, and struts of naval vessels to protect them against electrolytic action set up between two dissimilar metals. These coatings are resistant to petroleum products but do not have good resistance to acids or alkalis.

Production

In production work, mis-machined parts are sometimes salvaged by building up to drawing size, with sprayed metal. It is also possible to take a low-carbon, easily machined shaft and add a sprayed coating of hard steel only at those areas where wear resistance is needed. For semi-automatic spraying of small parts, tumbling-barrel setups are employed.

As a high-production tool, setups are arranged in which guns operate automatically and work is conveyed through the spraying zone mechanically. One or more pistols can be stationary or can move in controlled relationship over fixed patterns. The desired thickness is obtained by synchronizing spraying rates and conveyor speeds.

Metal hand illustrates accuracy of reproduction that can be obtained from spraying. Human hand was sprayed by the molten-metal gun with a bismuth-base alloy melting at 117 F to produce a negative shell. Negative was sprayed with alloy melting at 158 F and negative was then melted, leaving positive of hand



Pump sleeves illustrate the four steps in hard-facing. From left to right: (1) sleeve undercut and grit blasted, (2) surface sprayed with special alloy, (3) coating fused to base and rendered nonporous, (4) sleeve ground to finished size

The need for surface preparation is often a limiting factor. However, some materials need no preparation. In the electrical industry, copper is sprayed directly on carbon resistors and brushes, aluminum on cloth for condenser plates.

For other materials, it may be possible to install automatic blasting equipment on the conveyor. Part design, however, must be such that automatic equipment will do an effective job.

Usually, the controlling factor is the final unit cost of the product. Oftentimes, investigation reveals that the initial cost for a metal-spraying installation is less than the cost of equipment for any other competing process.

How to Prepare the Surface

SURFACE PREPARATION is one of the most important steps in metal spraying. Upon preparation depend two conditions that are essential for a good bond between the sprayed coat and the base metal.

First the base metal must be sufficiently rough that molten particles can lock themselves into crevices and irregularities as the spray strikes the part. Secondly, the surface must be free from dust, dirt, moisture, oil, and oxides.

To meet these requirements several methods are employed, with choice dependent primarily upon the shape of the part, the nature of the material to be roughened, and the use to which the part is put. Many early failures of metal-sprayed coatings can be traced directly to failure to give proper consideration to these points.

Sand or Grit Blasting

The oldest method of preparation is by blasting, either with hard, angular sand or angular steel grit. Blasting has its greatest application in preparing large flat or curved areas on objects that remain stationary during the operation. The vast majority of corrosion-resistant coatings are prepared in this way.

Sand, once commonly used, is now rarely employed except on site jobs, such as bridges, where the abrasive cannot be recovered. For efficient operation, the sand should be hard with angular faces. A silica, garnet, or flint sand is preferred and a 16 to 20 mesh size is generally satisfactory.

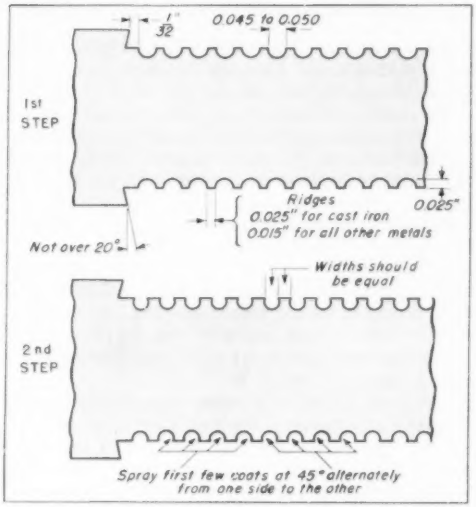
Steel grit eliminates all danger of silicosis and has a life estimated at 60 times that of sand. The selection of grit sizes varies with the work being blasted, but, in general, the smallest particle that will do a satisfactory job should be employed. Smaller particles permit increased blasting speed and thus lower costs. For the same reason, the highest pressure that gives good results on a given metal is recommended.

Lathe Methods

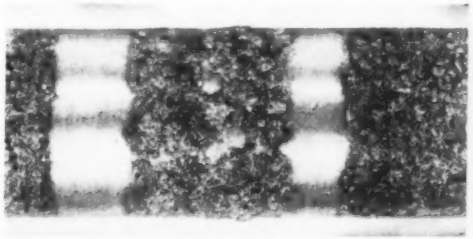
The second major method of preparation applies to cylindrical objects that are rotated during the operation. Falling into this group are the majority of machine elements that are reclaimed by metal spraying.

Although grit blasting may be applied for this purpose, the majority of work is done in a lathe by one of several methods: (1) rough threading, (2) threading plus knurling, (3) grooving plus roughening with a patented rotary shaft-preparation tool. For particularly hard objects, such as those having nitrided surfaces, none of these methods are suitable and it is necessary to employ electric bonding.

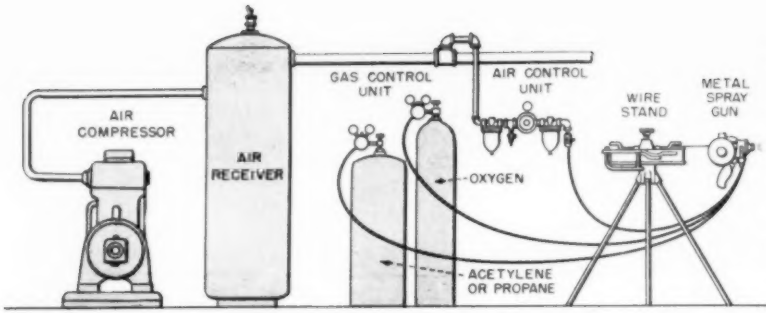
In rough threading a sharp-V thread is formed



Grooving method employs tool ground with standard rake and clearance angles for material being cut. Grooves are 0.025 in. deep, tool has not over 0.020-in. radius on corners, so sides of grooves are straight at surface of undercut. After grooving, special rotary tool roughens and spreads ridges so spaces and ridges are equal



Irregular surface produced by electric bonding is excellent for spraying. Large voids must be avoided



Conventional metal-spraying installation consists of gun, reel in which wire is held, fuel and oxygen supply controlled by two-stage regulators, and compressed air supply equipped with pressure regulators and moisture filters. Equipment for preparation and finishing operations is also needed

in one traverse of the work by a tool set below center, ground to tear a thread in the work, and run in a few thousandths beyond the full depth of thread.

The object is to produce as rough a thread as possible with numerous fissures for interlocking of the sprayed particles. Burrs are removed from the top of the thread by rotating the work with a flat tool just clear of the thread.

In the second method, threads are full 60°-V, 20 to-the-inch. Knurling is done with a standard 90° tool, $\frac{3}{8}$ in. wide by $\frac{7}{8}$ in. dia, containing 20 teeth per inch and fed in to a depth of 0.015 in. This treatment results in hooked anchorages that are regularly spaced both circumferentially and longitudinally.

In preparing the surface by grooving and roughening, a standard cutoff toolblade, ground to the proper form, is set to cut either a series of separate grooves or, by means of the lead screw, a continuous groove. The preparation tool, mounted in the toolpost with the toothed wheel square with the work, is then run back and forth over the surface to roughen and to spread the ridges until ridges and space between are of equal width. The purpose of this procedure is to provide a mechanical dovetail in addition to a roughened surface and thus insure good adhesion of the coating. On lightly stressed parts the preparation tool alone may be sufficient.

Electric Bonding

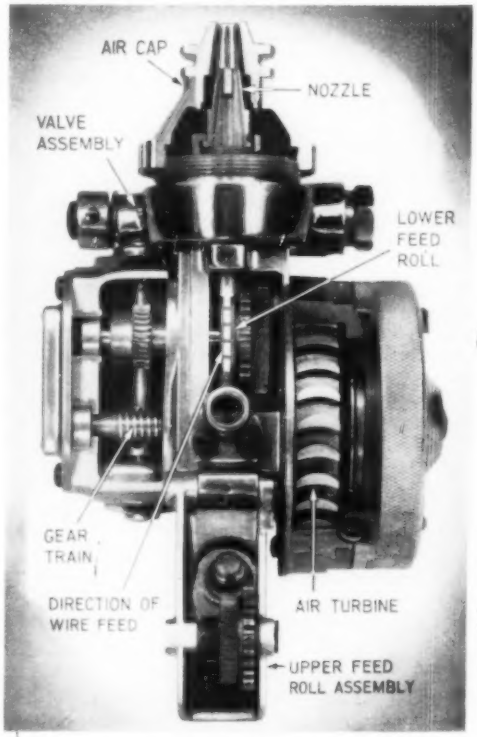
The electric-bonding method employs resistance heating to fuse a special electrode-metal to the base metal. This is accomplished by connecting one side of the secondary of a high-amperage, low-voltage transformer to the work, the other to the electrode holder. By a proper stroking motion of the holder, the electrode contracts the work and sets up an arc, heating the electrode and causing some of it to be torn away and fused to the work.

The deposit is an irregular mass with numerous cavities and thus affords an excellent surface for spraying. Both flat and cylindrical work may be prepared in this way.

Molecular Adhesion

A recently developed method is the spraying of a molybdenum alloy as a bonding undercoat for other sprayed metals. This alloy bonds itself to smooth, even polished surfaces, provided they are clean. It will adhere well to all common steels, stainless steels, Monel, nickel and chrome-nickel alloys, cast iron, cast steel, magnesium, and most aluminum alloys, but will not bond to copper and its alloys.

On many jobs, this new material makes possible the elimination of grooving, threading, and other conventional method of roughening. In their place,



Air-powered wire gun of typical construction consists essentially of power unit and gas head. Air turbine drives wire feed-roll through gear train to advance wire through nozzle. Air, gas, and oxygen enter head through connections below valve assembly and pass to nozzle. Upper feed-roll assembly swings into position above lower feed-roll when gun is operating

only a light, fast roughing cut is necessary. And even customary practice in undercutting can be modified. With the molybdenum undercoat, coatings can be tapered off to a feather edge, if the edge is outside the bearing surface.

Although the cost of the alloy by the pound is high, only about 0.0015 to 0.002 in. is required as an undercoat. Thus, its cost is more than offset by the savings it makes possible through the elimination of mechanical preparation operations. Savings also come from the fact that coatings require less metal than they do when sprayed over threads or grooves. Further, because coatings are smoother, less metal must be removed and less time must be spent in finishing operations.

The method is not recommended for highly stressed surfaces such as discontinuous coatings where heavy buildups are required, but is entirely satisfactory on continuous surfaces such as bearing or packing areas.

Factors in Selection

The lathe-tool and electric methods greatly increase the bonding area of coatings and also restrict contractions within the coating caused by shrinkage of the molten particles as they cool. In general, the thicker the coating and the higher the strain set up by the operating conditions of the part, the greater the roughening required.

Shrink characteristics of different metals also affect the type of preparation. Low-carbon steels have high shrink and need a much stronger bond, particularly on heavy coatings. High-carbon steels, on the other hand, have very low shrink.

Depending upon the requirements of the application, the major methods are applied in full or in part, or even in combination.

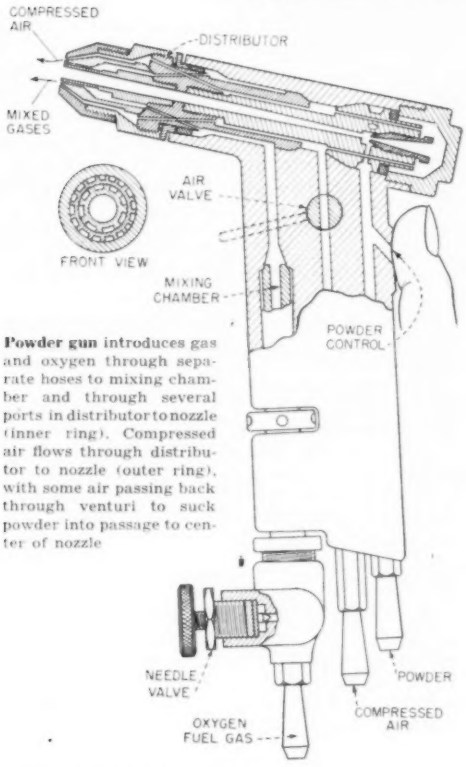
Non-Metallic Surfaces

Some non-metallic surfaces are sufficiently porous that they require no surface roughening. Examples include, brick, wood, and some cloth. Others, such as plaster or plastics, require light blasting.

On glass, the accepted preparation is to heat before spraying. A fusion bond is thus obtained.

It is absolutely essential that prepared surfaces remain clean and free from oil. All undercuts must be machined dry. To avoid oxidation, no more than four hours should elapse between preparation and spraying of a given piece.

Application of the Coating



Powder gun introduces gas and oxygen through separate hoses to mixing chamber and through several ports in distributor to nozzle (inner ring). Compressed air flows through distributor to nozzle (outer ring), with some air passing back through venturi to suck powder into passage to center of nozzle

THE SECOND major phase of metal spraying is the application of the coating. It is in this step that control over the process lies. Quality coatings of uniform texture depend primarily upon proper operation of the gun and correct spraying techinque.

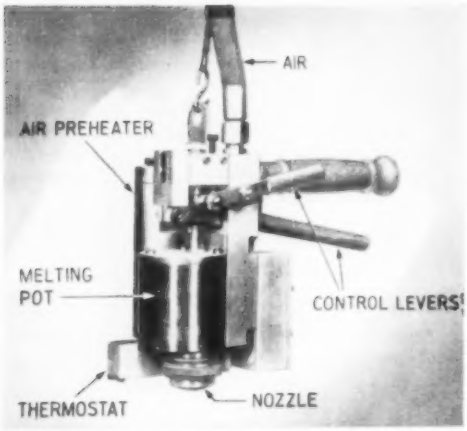
Metal-spraying guns are of three major types: wire, powder, and molten-metal. These classifications are based upon the state of the metal as it enters the nozzle of the gun.

Wire Process

Most widely applied is the wire process. Wire moves continuously through a nozzle into a gas-oxygen flame fed at high pressure through ports drilled in the nozzle. Surrounding the nozzle are passages for compressed air. This high-pressure stream envelops the flame cone and, as the wire melts, provides the impelling force for projecting the globules of molten metal against the surface to be coated. The wire is advanced by rollers driven through a reduction gear train by a high-speed air turbine or, in a recent design, by an electric motor.

Guns are manufactured in several models of differing capacity and flexibility. Those that are most versatile spray all metals, take a range of wire sizes, and are readily adapted to burn any of the following gases: acetylene, propane, hydrogen, natural or manufactured gas.

Pressures for gas and oxygen vary with different gases and different guns and are controlled by regulators in the lines. For a given gas and gun, pressures are set to the same value for all metals; thus, the flame is at constant temperature and the speed



Molten-metal gun, designed to operate in vertical position, requires 4 to 6 cfpm of compressed air. Gun melts metal electrically and has top limit of 600 F

with which wire of a given diameter is driven depend upon the melting point of the metal; and rate of wire feed determines the rate of deposition in pounds per hour. Modern high-production guns, taking 3/16-in.-dia wire (the maximum size) can spray stainless steel at 21 lb per hr and zinc at 55 lb per hr.

Speed also controls the degree of atomization, with slower speeds producing finer coatings. A slower speed results in the wire melting closer to the tip of the gun. For greatest efficiency the speed should be adjusted so the wire melts as far from the tip as possible for a coating of satisfactory particle size.

For coatings of uniform texture, speed should remain constant and gas-oxygen volumes should be held in proper balance. Some guns depend upon regulators in the line for constant pressure to the turbines; others operate at full line pressure and are equipped with a governor to compensate for fluctuations; the electric-drive gun has a constant-speed motor. Fuel rations often are controlled by regulators only, but added accuracy is possible with flow meters in the line.

Air pressure should be a minimum of 50 psi and guns normally require from 25 to 40 cfm. For shops that have only small compressors or for various small jobs, guns requiring as little as 10 cfm are available. Oxygen should be adjusted for a neutral flame in both the wire and powder pistols.

For rapid deposition of the higher-melting metals, the wire gun cannot be equaled. Reclamation work is done almost exclusively by this method.

Powder Process

In the second major process, metallic powders are held in a container apart from the pistol. Within the pistol, the compressed-air stream creates a vacuum that causes the powder to flow, suspended in air, from the container through a hose to the pistol. Melting and atomization then occur in a gas-oxygen flame surrounded by compressed air, as in the wire gun.

Pistols take powder from 100 to −325 mesh, with the exact range depending upon the size of the gun. Generally, the higher the melting point of the metal, the finer the mesh should be. And for any metal, finer powders mean faster heating and finer, denser coatings.

For each different melting point, flame temperature is adjusted accordingly. Normal practice is to set gas and oxygen pressures to either one of two constant values—high or low—and then control flame temperature by varying the volume of compressed air surrounding the flame.

The volume of powder flow is adjusted by bleeding air into the powder container. Clean air is of utmost importance to avoid clogging of the powders.

One advantage of the powder pistol is its lack of moving parts. Further, alloys not obtainable in wire form are available in powder form and mixtures of powders can be made that are not alloyed in any form. This is of particular benefit in laboratory work. The pistol also requires somewhat less fuel and air than the wire gun.

On the other hand, the powder pistol is intended primarily for metals in the lower melting range and for plastics.

Molten-Metal Process

Molten-metal pistols made in the United States are limited to a maximum temperature of 600 F. Within the gun is a crucible and a thermostat-controlled electric heating unit. Metal is inserted in bar form, melts, and is sprayed with compressed air. Metal also can be melted separately and poured into the crucible.

One gun operates in the vertical position, another in the horizontal. Very little movement out of either plane is possible. Although the gun can be moved, work normally is passed into the spray.

The texture of the spray is controlled by the air pressure, with the higher pressure giving the finer spray. On a production job, pressure is held constant. For close reproduction, as in cores for electroforming, the highest pressure is employed until a thin initial coating is deposited, then pressure is reduced for building up to the required thickness. Deposit efficiency is low at high pressures.

The process has had but limited application thus far, primarily with the very-low-melting-point alloys.

Spraying Techniques

In spraying stationary objects, metal-spray guns are held by the operator and the evenness of the coating depends largely upon his skill. It is known how much metal needs be sprayed to cover a given area to a predetermined thickness. The correct weight is supplied the operator for a given job.

The entire area is covered with one layer; then the second layer is applied at right angles to the first and so on, alternating the direction of spraying on each layer.

Spraying distance and rate of gun traverse across the work should be held as nearly constant as possible. The actual rate of traverse varies with each job, depending upon the speed of spraying and the thickness of the layer.

For example, if the operator passes the gun across the surface with the same speed for all metals, he will apply a heavy coating of the faster spraying metals and a lighter coating of metals that spray slowly. With experience, operators learn to judge the correct speed of movement and to obtain remarkably uniform coatings.

On lathe jobs the gun is often mounted on the toolpost and advanced across the work with power feed. Layer thickness is readily controlled by varying either the speed of work rotation or the carriage feed.

The deposit thickness for one pass of the gun may be either a thin layer of 0.005 to 0.015 in. or the full thickness of the coating. In any event, several moderately thick layers should never be used because they tend to cause layer separation.

Spraying distance is 5 to 10 in. The pistol is held perpendicular to the work and should be continuously on the move. If the pistol is held in one spot for an appreciable time, the coating is overheated and the base also heats up. The result is increased oxidation and accumulation of metal dust. Such inclusions are the greatest cause of layer separation in metal-sprayed coatings.

Shrinkage

Sprayed metals shrink as they cool, the amount varying with the different metals. Shrinkage seldom causes trouble on thin coatings or in continuous coatings on the OD of cylindrical parts. But on discontinuous coatings—such as on shafts with keyways, on inside diameters, and on flat surfaces, shrinkage weakens the bond and may cause the coating to pull loose from the base.

To avoid trouble, surface preparation is increased and extra precautions are taken during spraying. Coatings may be applied in thin layers with time allowed between the spraying of each layer; coatings and work may be air-cooled; work may be preheated to the maximum temperature it may be expected to reach during the spraying operation.

The major points in the operation of the metal-spraying gun are these: (1) Adjust gas-oxygen ratios for a neutral flame; (2) Spray at maximum speed for the degree of atomization required; (3) Hold spraying distances to the permissible minimum; (4) Keep the gun continuously on the move.

Careful adherence to these few rules will avoid trouble in subsequent finishing operations and will do much to give at minimum cost a high-quality coating that will offer the utmost in service life.

How to Finish Sprayed Metals

ALL SPRAYED METALS have a matte finish. They may be left in the "as-sprayed" condition, wire brushed, polished, machined, or ground.

Coatings darken upon exposure to the atmosphere if left "as-sprayed." If wire brushed, sprayed surfaces develop an excellent sheen.

In polishing, the same operation sequence as for a casting is satisfactory. Care must be exercised to avoid over-heating the work and wearing through the coating.

Lower-melting point metals readily respond to these operations, but harder metals, such as sprayed steel, are extremely difficult either to wire brush or to polish.

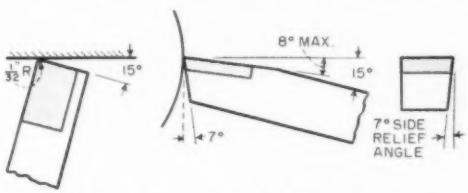
RECOMMENDED SPEEDS AND FEEDS FOR CARBIDE TOOLS ON SPRAYED METAL

MATERIAL	SPEED (sfpm) ROUGH	SPEED (sfpm) FINISH	FEED (in./rev.) ROUGH	FEED (in./rev.) FINISH
Yellow brass	250-300	300-350	0.006"	0.002"
Commercial Bronze	250-300	300-350	"	0.002
Manganese Bronze	250-300	300-350	"	0.003
Phosphor Bronze	250-300	300-350	"	"
Tobin Bronze	250-300	300-350	"	"
Copper	250-300	300-350	"	"
Iron	75-100	100-125	"	"
18-8 Stainless	100-125	125-175	"	"
Hi-Chrome Hi-Carbon Stainless	30-40	30-40	0.004	"
Monel	200-250	250-300	"	0.002
Nickel	200-250	250-300	"	0.002
Steel 10 carbon	75-100	75-100	0.006	0.003
Steel 25 carbon	50-75	50-75	0.004	"
Steel 80 carbon	30-40	30-40	"	"

Cutting Characteristics

Most machine-element coatings are sprayed oversize to allow for finishing to size either by machining or by wet or dry grinding. Undoubtedly, the best method is wet grinding and where extremely close tolerances must be held this is the only method that should be employed.

Wheel selections for sprayed metals are different,

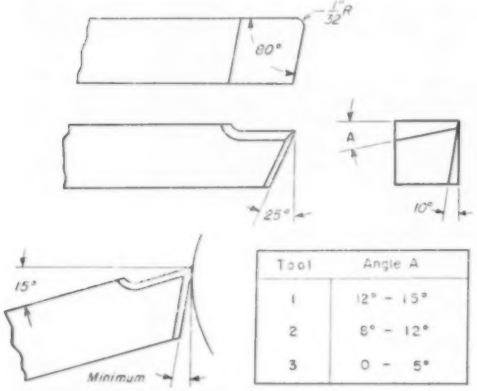


Carbide tools are ground and set as shown. Side cutting angle is unimportant as cuts are light

however, from those for the same metal in the solid form. The same is true for tool angles, tool settings, speeds, and feeds. This stems from the fact that sprayed metals differ from the original metal in many physical properties, among them hardness, density, ductility, and tensile strength.

Failure to recognize these basic differences in sprayed metal is one of the major causes of difficulty in finishing operations. Conventional practice leads only to grief. Yet troubles can be avoided if sprayed metal is regarded as a material in itself and practices best suited to its characteristics are adopted. For this reason extensive tests have been run and data have been compiled to guide users in the proper way to handle each of the sprayed metals. Results are shown in the accompanying tabulations and sketches.

The major problem in grinding is the loading of the wheel, with consequent danger of overheating the coating. Wheels, therefore, are generally medium or coarse grain with low bond strength. For wet grinding, wheels are usually run at 6000 to 6500 sfpm and the work at 80 to 90 sfpm.



Tool	Angle A
1	12° - 15°
2	8° - 12°
3	0 - 5°

Tool angles recommended for machining sprayed metal with high-speed tools. Numbers correspond to those listed in table of speeds and feeds

RECOMMENDED ANGLES, SPEEDS, AND FEEDS FOR HIGH-SPEED TOOLS ON SPRAYED METAL

METALS	TOOL NUMBER	SPEED (sfpm)	FEED (IN. REV.)
Aluminum	1	125-200	0.003-0.005
Babbitt	1	150-250	0.005-0.008
Brass-Yellow	2	100-125	0.003-0.005
Bronze-Commercial	1	100-125	0.003-0.005
Bronze-Phosphor	3	100-125	0.003-0.005
Bronze-Tobin	3	100-125	0.003-0.005
Copper	1	100-125	0.003-0.005
Lead	1	150-250	0.005-0.012
Monel	1	100-125	0.003-0.005
Nickel	1	100-125	0.003-0.005
Iron-Swedes	1	50-100	0.003-0.005
Steel—10 carbon	1	75-100	0.003-0.005
Steel—25 carbon	2	50-100	0.003-0.005
Steel—40 carbon	2	50-100	0.003-0.005
Steel—80 carbon	0	GRIND	0
Steel—120 carbon	0	GRIND	0
Stainless—18-8	1	100-125	0.003-0.005
Stainless—Hi chrome	0	GRIND	0
Tin	1	150-225	0.006-0.008
Zinc	1	150-225	0.006-0.008

A mixture of ½ kerosene and ½ cylinder oil brushed on liberally about 30 minutes before machining will improve the finish of commercial bronze or yellow brass considerably and that of aluminum and copper slightly. On iron and steel the solution permits higher speeds and gives longer tool life. It is particularly helpful in machining hard sections in coatings. The mixture should not be used on stainless steel, monel, nickel, or tobin or phosphor bronze, as it will impair, rather than improve, the finish.

Turning Operations

In turning, tools are set slightly above center with front clearance at a minimum. A little experimenting will indicate the exact setting that gives best results.

Inside diameters are best finished by internal grinding, but boring can be done. An extremely light-cut and feed is necessary and the toolbit is ground to approximately the same angles as recommended for turning.

Flat surfaces can be surface ground with the same wheels recommended for cylindrical grinding. Or they may be finished in a planer or shaper with the tool ground as recommended for lathe work. First, however, all high spots must be filed or ground off to avoid catching the tool and gouging the work. Very light cuts must be taken.

The same precautions apply to milling, which is at best a risky operation because of the tendency of the cutter teeth to chip and crack the coating.

Carbides are highly recommended, as their extreme hardness is ideal for resisting the abrasive action of the oxide and carbide inclusions in the sprayed metal. Although higher speeds are possible, the limits in the accompanying tabulation will give economic operation based on a balance of tool wear and regrinding time against speed of metal removal.

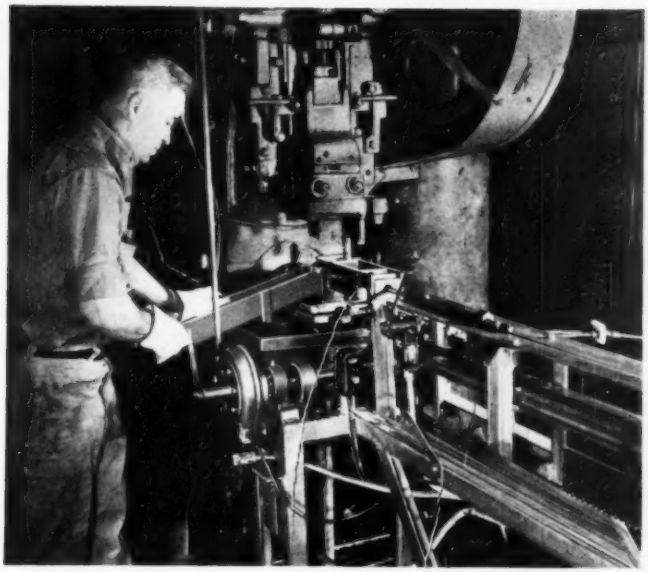
We acknowledge *the generous cooperation of the following firms and organizations that made possible the preparation of this report:*

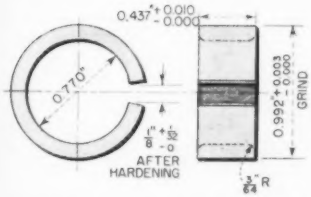
Alloy Metal Wire Co.
American Metallizing Contractors Association
Metallizing Company of America
Metallizing Engineering Company
Schori Process Division—Ferro-Co Corp.
The Metal Spraying Corp.
Wall Colmonoy Corp.
Wm. F. Fiore, Inc.

Feeder and Heater Speed Magnet Forming

Manual handling and guess heating superseded by automatized setup, cutting rejects and lifting output from 500 to 1360 per hr

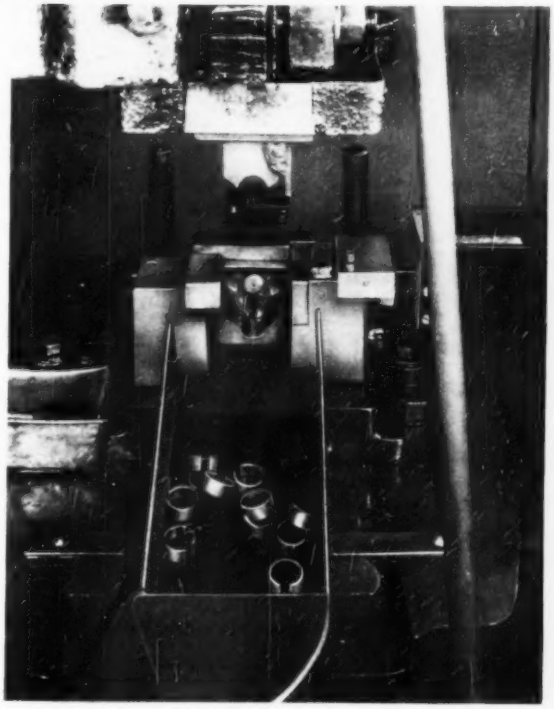
BY HENRY ORTH
Foreman, Heat-Treating Dept.
STEWART-WARNER CORPORATION





Speedometer magnets are formed of either 0.437- or 0.562-in. stock 0.110 in. thick ±0.004 in.

Strip stock, received in 11½- to 14-ft. lengths, is fed by the chain-controlled feeder (right) through an induction-heating coil powered by a GE 15-kw electronic heating unit. Operator can change heat from this position, reading dials on cabinet (off right) by a mirror. Heated stock enters a 50-ton, No. 4 horn press. Stock feed is lever-actuated from the press, and when stock is used up, feeder is returned to starting position by hand crank shown

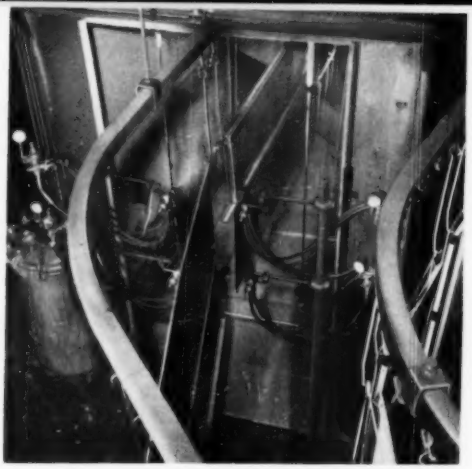


Heated stock enters die from right, is sheared to 2.608 in. and formed around the horizontal pin extending from the die slide. As the die slide moves up at stroke end, the formed ring is pushed off into the chute, which leads to a totebox. Rings are later reheated and sized in a 50-ton punch press, then hardened and drawn to 61 Rockwell C. This increases diameter about 0.005 in. They are magnetized and stabilized by low-temperature treatment. The commonest material contains 1.05-1.15%C, 3.8-4.2% Cr, 0.3-0.5% Mo, and 3-3.5% Co, and must be heated to 1475-1525F. Another has 0.7-0.8%C, 3.75-4.25% Cr, 4.75-5.25%W, and 17-19% Co, and must be heated to 1550-1600F. Heating must be adjusted to suit width and composition, because temperature is critical

CONVEYORIZED FINISHING HELPS CUT COSTS

Loops and whorls in paint conveyor line make use of every available foot of space in metal-furniture finishing room

BY ART SHELDON, Plant Superintendent, CESSNA AIRCRAFT COMPANY



Aluminum locker parts are sprayed electrostatically in two identical booths. Prime coat is applied in the first booth, finish coat in the second. Each booth is double-ended to permit spraying from both directions to obtain maximum coverage. Spray sections of the booth are at right angles to each other, with a common exhaust at the corner

PRODUCTION of some other-than-aircraft items has been undertaken by Cessna Aircraft Co. to supplement its present aircraft schedules. Thus, while holding its position as the largest manufacturer of personal planes in this country, the company is putting to profitable use its war-expanded production facilities. A sizable volume of aluminum lockers and table and chair parts are now manufactured in factory departments formerly given over to production of sheet-metal aircraft components.

Complete conveyorization of all finishing operations, and the use of automatic machines and methods, wherever possible, was decided upon at an early stage in the production planning for locker and furniture parts as prerequisites for a minimum-cost painting job in the smallest possible floor area. In the over-all savings picture, the features at the Wichita plant are:

(1) Ransburg electrostatic spray for application of prime and finish coats to all pieces.

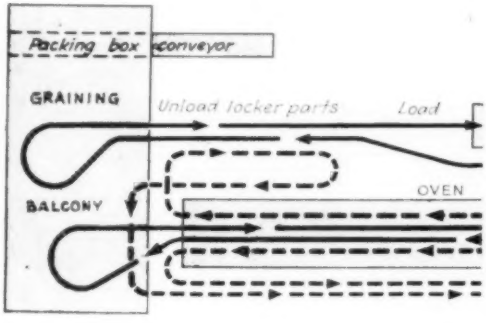
(2) One oven for all baking operations on the two lines.

(3) Establishment of a packing and shipping department directly opposite the unloading station of the locker finishing lines.

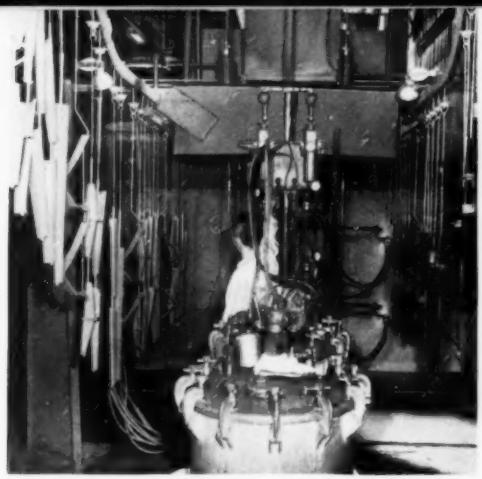
Electro-Spray proved to be the most valuable single element of the installation. This process is automatic and is capable of high-volume, conveyorized operation. It permitted Cessna to spray locker parts in half the floor space, and with less than half the labor required for hand spraying. In addition, paint savings characteristic of the process were realized, through the substantial reduction of overspray as compared with other spraying methods. This is made possible through application of the coating material in an electrostatically charged zone in which the paint is actually pulled toward the work surfaces.

The company derives more benefit from electrostatic spray in the locker line because production is higher than on the furniture line. Locker production averages 340 complete units per day. This represents 40,000 sq ft to be primed and finish-coated. The conveyor carrying locker parts moves at 8½ fpm and is in continuous operation for 16 hr a day. All equipment required to do the finishing job has been installed on this conveyor in a length of 900 ft, including two Electro-Spray units, so bare parts loaded on the conveyor are ready for packing at the end of a 1.75-hr cycle.

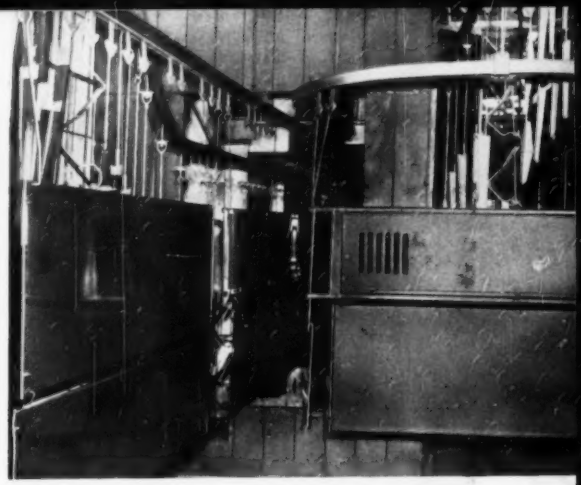
Although most locker parts are essentially flat sheets, all have flanged sides or ends. By spraying in opposite directions in double-end booths, maximum coverage is obtained. Coverage of the prime coat is adequate as applied by Electro-Spray alone.



Locker conveyor line (solid line) is kept level as dips could not be negotiated without interference between the 6-ft-long pieces spaced 6 in. apart on conveyor. Work travels 195 ft to air dry the prime coat before entering finish booth. Furniture conveyor (dotted line) rises over locker line in ten places, and climbs to balcony where prime-coated pieces are grained



Furniture parts receive both prime and finish coats electrostatically in this divided booth. One operator easily supervises both operations. Center partition extends to water curtain, permitting a common exhaust for both sides of the booth



Three separate baking operations are done in one conveyorized 100-ft-long oven. Prime coated furniture parts enter at right side, finish coated pieces at left. Locker conveyor moves twice as fast, so finish-coated locker parts go twice through the oven to get an equivalent bake

The finish coat is supplemented by hand spray to obtain complete coverage in areas shielded from electrostatic deposition. This handspray operation is required on 10% or less of the total surface.

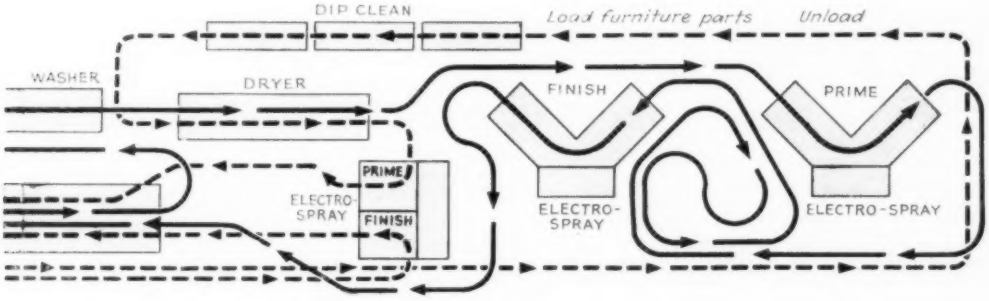
Height of pieces as hung on the conveyor is effectively the same for all parts, permitting them to be sprayed with a single setting of the automatic spray guns. This feature permits the operator to mix paint as well as attend to his other duties.

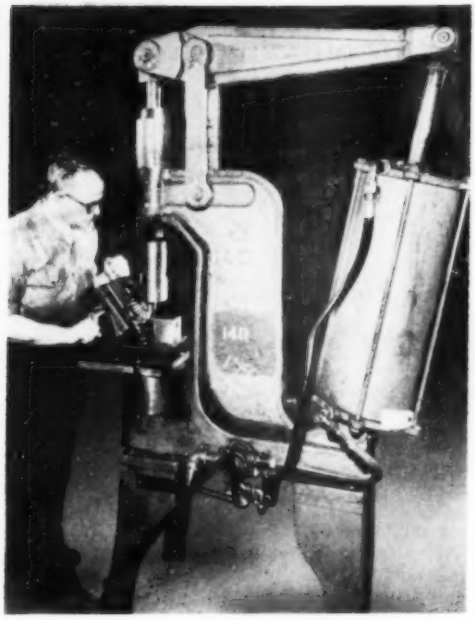
The furniture line moves at half the speed of the locker conveyor and is a one-shift operation. A total of 4700 pieces, chiefly chair and table legs, are finished on this line each day. Pieces are grouped closely on the conveyor—average hanger spacing is 6 in.—and are rotated as they are sprayed. These pieces are removed from the conveyor for graining after the ground coat is sprayed and baked. After graining they are rehung on the conveyor for electrostatic coating with a clear urea enamel. Graining is done in automatic machines requiring five operators and three brush touchup personnel. Application of both ground and finish coats is handled by one spray booth operator, as the two coats are applied in adjacent units using a common exhaust.

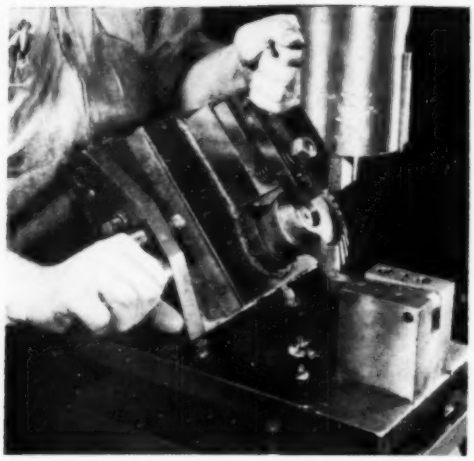
One direct gas-fired infrared oven is used for all baking operations. It bakes the locker finish coat and both prime and finish coats on the furniture pieces. All these materials require an approximately equivalent bake—20 to 30 min at 300 F. This is accomplished in one pass through the oven for each coat on the furniture line. Two passes are required for the locker line, which travels at double the speed of the furniture line. Four lengths of conveyor track run through the 100-ft-long oven, whose length is the limiting factor of conveyor speed for the locker line.

Locker parts are packed immediately after removal from the conveyor. Packing is done in minimum space, and the need for finished parts storage is virtually eliminated. This is not possible on the furniture line, as assembly is required.

Before this finishing department was installed, furniture pieces were sprayed by hand. At that time, these pieces required a three-coat finish without graining. The present furniture finishing line, plus the entire locker finishing line, now occupies the same floor space previously required for the furniture line alone.





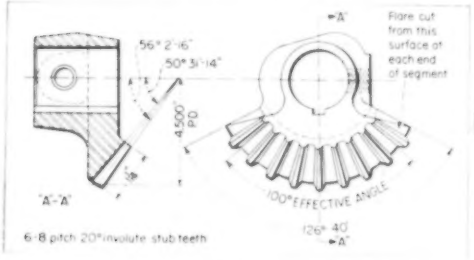


Tilted fixture at left and above holds gear at 50° 31 min., the root angle of gear teeth, and toolbit cuts away flare to root depth of adjacent tooth. Formed end of locator arm in block fits between first tooth and flare to align tooth and cutting tool. Arm is held in horizontal position by heavy spring and is pushed down out of way by descending toolbit. Tantung toolbit is ½ in. square, has 0.005-in. flat on cutting edge and 60° back rake angle

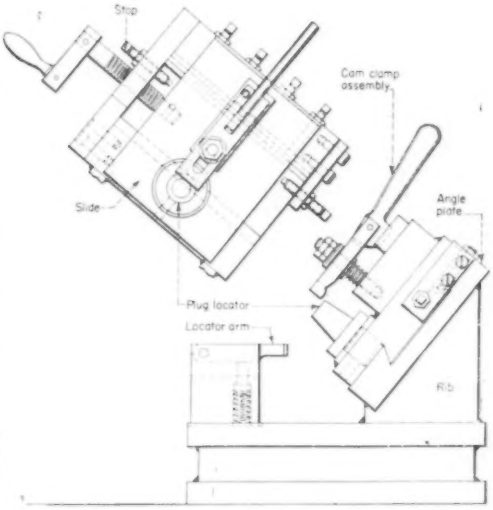
AIR PRESS TRIMS SEGMENT BEVEL GEARS

BY PAUL BLUDAU, West Allis Tractor Works
ALLIS-CHALMERS MANUFACTURING COMPANY

UNTIL recently, a flared portion of tooth on each end of segment bevel gears for the steering mechanism of Allis-Chalmers agricultural tractors was removed by hand at considerable expense. Now, development of a tilted fixture for a standard pneumatic arbor press permits cutting one flare from gear with each stroke of the press. The tilted fixture has a screw-actuated slide for shifting the work locator so flares are trimmed from both ends of the segment without removing the gear from the fixture. The job is completed in two press cycles and cost is reduced considerably.



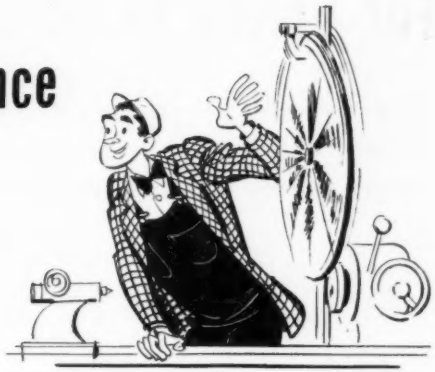
Forged steel gears for tractors have flared portion of tooth at each end of segment after teeth are cut



Welded fixture is made principally from SAE 1020 steel plate, normalized to relieve welding strains. Interchangeable work-locator plugs accommodate four different segment bevel gears. Same front locator arm fits the four gears, because all have same tooth specifications. Locator plugs are SAE 1025 steel, carburized and hardened to 57-60 Rockwell C before grinding all over

ROUND TABLE

Ten Cents A Chance



"Say, Ed, as I passed Patterson's bench, I saw a 1-in. micrometer reposing in a black-velvet-lined case—and beneath it a small sign."

"What'd the sign say, Al: 'Don't use me for a C-clamp'?"

"No, Ed, it was a very businesslike: '10 cents a chance'!"

"Oh, oh," laughed Ed, "Pat's in a low spot again—needs some cash."

"What do you think of the idea, anyway?"

"Oh, I don't let a little thing like that worry me, Al. Raffles seem to be the favorite pastime in my shop—have been for some years now."

"Well, my gosh, Man, what're you running around here, a bazaar? First thing you know, you'll find one of the toolmakers playing a flute over a basket and a shaper hand selling piston rings three for a quarter to throw at his down-feed handle."

"No danger of that. It's strictly a business proposition with some of the boys, and I find no complaints from any of the men. Last year young Mahoney got rid of his whole kit of tools that way before he went into the police force—said to me he wouldn't have any use for mikes and such when he was hauling in a drunk."

"Do you think such things build good atmosphere in a shop?"

"Don't see what harm it's going to do anyone—might do the raffler some good, though. And it satisfies the boys' sporting blood so they don't get tangled up with something that will cost their shirts."

"Oh, I know, Ed," reasoned Al, "But why not have a shop as a shop and not a market place? Such things eat into time, you know, and there's always the chance of a loser claiming the picking was fixed. Or even of the raffler *doing* a little fixing for a friend."

"The time isn't much, Al—no more than the boys would waste gabbing anyhow. It's a sporting proposition, and everybody with his dough down for a chance is going to be there to see the number drawn—and to check the numbers if anything looks phony."

"You're still running a mild gambling joint, Ed—and anything can happen. When it does, your whole organization will fall down like a stack of cards."

"Since when are you a puritan, Al? Nothing's ever happened yet—and if I try to stop it here, they'll call me a sourpuss and run their raffles outside. That'd hurt morale more than this ever could. Can I lend you a dime?"

***ARE RAFFLES** merely harmless fun, frequently for good causes, or do they hold potential headaches for the foreman or other executive who lets them go on? Can they be stopped—or does the attempt just "push them underground"? Your ideas on this subject will interest others. Discussions of earlier topics appear on later pages.*

How to Detail and Inspect Parts For Bolted Assembly

Four case examples serve to clarify this subject in order to avoid misunderstanding between product designers, tool designers and inspectors

BY M. F. SPOTTS
The Technological Institute
NORTHWESTERN UNIVERSITY

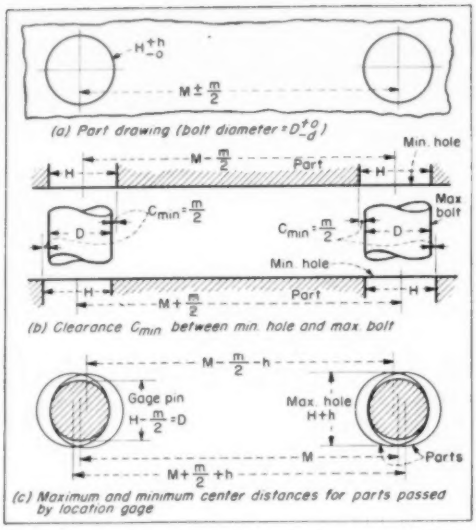


Fig. 1 . . . *Two parts, each with two holes, assembled with loose bolts:* if an additional working clearance C_o is added to ease insertion of each bolt, the minimum clearance between bolt and hole $C_{min} = m/2 + C_o$

WHEN component parts are fitted together with bolts or rivets, clearance must be provided between the hole of minimum diameter and the bolt of maximum diameter. The clearance must be sufficient to insure assembly even with the most unfavorable selection of parts. It is significant that this clearance is related to the tolerance on the dimension for the hole centers.

Case I — Two Parts Assembled by Two Bolts

Let Fig. 1(a) be the detail drawing for the two parts. Fig. 1(b) shows the condition of assembly for parts with the minimum hole diameter H. One part has hole centers at the minimum distance permitted by the drawing, the other part has hole centers at the maximum. Thus, the *least* amount of room remains for insertion of a bolt of maximum diameter D.

Summation of the horizontal dimensions shows that the minimum clearance C_{min} between minimum hole diameter H and maximum bolt diameter D must be equal to $m/2$, or one-half of the total tolerance on the hole centers. The dimensions on the drawings should therefore be arranged in accordance with this result.

Fig. 1(b) shows a neat fit between the parts. Should some additional clearance C_o be desired for insertion of each bolt, the minimum clearance becomes:

$$C_{min} = H - D = \frac{m}{2} + C_o$$

This result can be easily verified by making a sketch similar to Fig. 1(b) in which a clearance $\frac{1}{2}C_o$ appears on either side of the bolt.

What about inspection of parts with the detail dimensions given in Fig. 1(a)? Hole diameters can be checked with a go and not-go plug gage; the bolt diameter with a snap gage. Construct a fixed-type location gage for checking the position of the holes with respect to each other. This consists of a steel block with two pins located at distance M, center to center. Parts that receive the pins are considered acceptable; those which do not will be rejected.

The gage-pin diameters can be determined by noting in Fig. 1(b) that parts must not invade the space occupied by the bolt. Otherwise, assembly might not be possible with any other chosen part that has been passed by the gage. Hence the size of gage pin D in Fig. 1(c) is made equal to $H - (m/2)$.

A gage of this kind will pass parts with a center distance that is not in agreement with the drawing. Suppose in Fig. 1(c) that the parts have the maximum permissible hole diameter $H + h$, and that these holes are at the maximum or minimum distance apart that the gage will accept. For extreme cases the center distance could be a distance h greater or less than that called for on the drawing.

In the usual case no harm is done; the gage passes parts that will assemble, which is usually the important thing. By demanding that a part be strictly in accordance with the drawing usually adds nothing to the product value and may add much to its cost. But, it should be understood by everyone that such a center-distance variation is possible whenever a fixed location gage of this type is used for inspection of parts with holes dimensioned as in Fig. 1(a).

Case II — Two Parts Each With One Hole Located From a Datum

The detail drawing is shown in Fig 2(a) and the condition for tightest assembly is shown by Fig. 2(b). The clearance between minimum hole H and maximum bolt

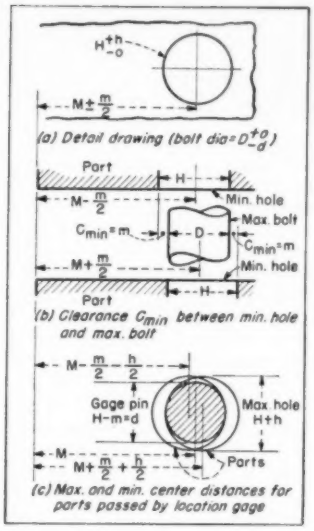


Fig. 2 . . *Two parts, each with one hole located from datum and assembled by loose bolt:* with working clearance added, the minimum clearance is $C_{min} = m + C_o$

D is equal to m, the total tolerance on the dimension to the hole center. Should an additional working clearance C_o be desired for insertion of the bolt, the equation for minimum clearance, will be

$$C_{min} = H - D = m + C_o$$

Dimensions on the detail drawing should be in agreement with this equation.

The extreme limits for the dimension to the hole center for parts inspected by a fixed location gage are given in Fig. 2(c).

Case III — Part With Two Holes Assembled to Part With Two Fixed Studs

Fig. 3(a) gives the details of the two parts, and Fig. 3(b) shows the tightest conditions of assembly. The clearance between minimum hole H and maximum stud D is equal to m, the total tolerance on the hole centers. The equation for the minimum clearance when there is a working tolerance C_o at each stud becomes:

$$C_{min} = H - D = m + 2C_o$$

Dimensions on the detail drawings should agree with this equation.

The extreme limits for the center distance for parts passed by a fixed location gage are shown in Fig. 3(c).

Case IV — Part With One Hole Dimensioned From Datum to Be Assembled to Part With Fixed Stud

The details, assembly, and gaging dimensions for this case are given by Fig. 4. The clearance between minimum hole and maximum stud, with a working clearance C_o is equal to

$$C_{min} = H - D = 2m + 2C_o$$

Changes will occur in the diameter of gage pins or holes of the foregoing when clearance C_o is used.

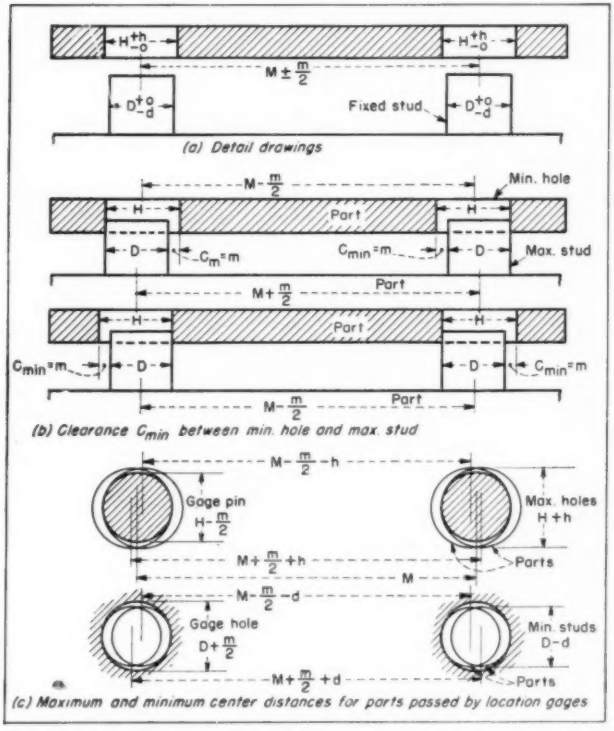


Fig. 3. . *Part with two holes assembled to part with two fixed studs:* with working clearance added, the minimum clearance $C_{min} = m + 2C_o$

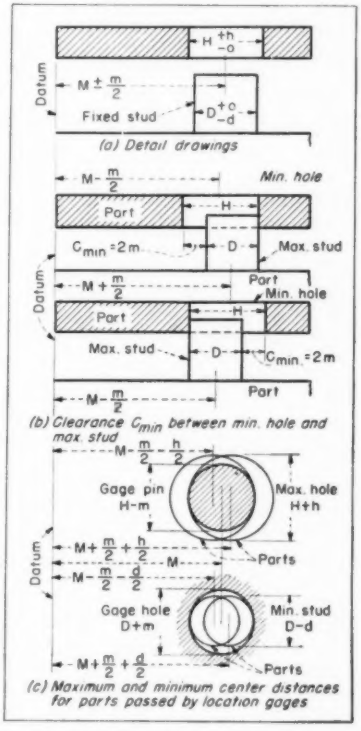
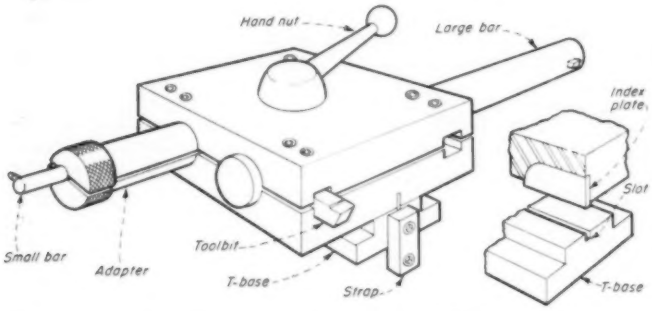


Fig. 4. . *Part with one hole dimensioned from datum to be assembled with part with fixed stud:* with working clearance added, the minimum clearance $C_{min} = 2m + 2C_o$

Practical Ideas



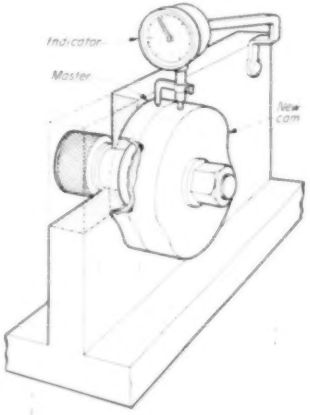
Grown-Up Boring-Bar Holder Acts as Simple Turret

A TOOLHOLDER designed originally to hold outsized boring bars was adapted over a length of time for other operations, until, as it now stands, it is practically a turret toolpost. It is much easier, however, to make than a standard turret, and can be fabricated in small shops to speed operations.

Two large holes through the split body hold large bars or smaller ones supported in split, eccentrically drilled adapters. Square slots at right angles to the bar holes are for clamping toolbits, and for this purpose there are setscrews mounted perpendicular to the slots. Bar clamping is done with the hand-nut assembly on top.

Indexing is done by hand, with four indexing plates, set in the block and extending below the lower surface slightly, slipping into a pair of corresponding slots in the T-base in pairs. If the top of the T-base is slightly below the top of the compound rest of the lathe, on which the block is mounted, only a partial turn of the hand nut will release or tighten the block in position.

Screw straps are bolted into the ends of the T-base to allow bolting the block to the compound. Dimensions must be made to suit any particular compound, especially those of the T-base. The size of the block itself depends largely upon the size of tools to be handled. *Allan B. Nixon, Springfield, Mass.*



Cam-Checking Setup Gives Dial-Indicator Accuracy

SMALL-BATCH CAM production often requires shaping the blanks on a filing machine, and after this operation the cams must be checked against a master. When a comparator is not available or impractical, this setup is both simple to make and is accurate.

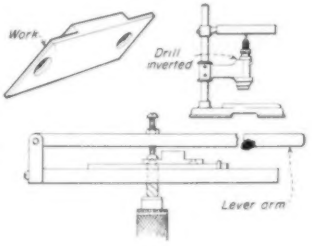
The master and cam are clamped together on a shaft mounted on an angle plate. A knurled knob is provided for rotating the two, and an arm carries a dial indicator. The shank of the indicator is fitted with a leg clamped tightly in line with the spindle. The leg must be checked before cams are inspected by dropping it down to the bare shaft and setting the indicator to zero. Then any deviations in the cam from the master will show up as plus and minus readings.

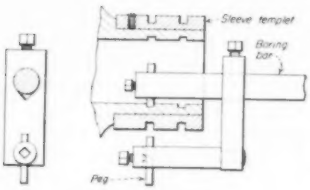
Three precautions are necessary: the leg and indicator spindle must be level at their tips when the indicator reads zero; the cam and master must be matched perfectly on the shaft; and the pivot of the dial-indicator support arm must hold the arm without allowing any twist. *Gerhard Wenke, Los Angeles, Cal.*

Clamp Lever Forces Work Onto Countersinking Tool

ACCURATE countersinking was done with a drill unit inverted under a drill table and carrying a countersinking tool. The part was rough on top, and the holes had already been drilled.

With the height of the tool fixed, the part was held on the point of the tool by the operator until he brought down the lever with his other hand. Fitted in a drilled and tapped hole in the arm, a screw with a cut-off screw head fastened to its end clamped over the hole in the part and forced the part down onto the countersink. *E. C. Schlenker, Glendale, Cal.*





Sleeve Templet Aids in Accurate Recessing

INTERNAL RECESSES can be cut accurately inside small holes on a production basis if a templet sleeve is fitted over each part after it has been chucked.

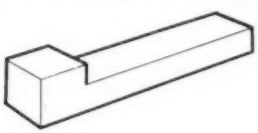
The templet is bored out to fit over the end of the part and a setscrew hole is drilled and tapped for locking it in place. A peg follower is clamped in an extension on the boring bar to check tool alignment. This can be made from drill rod, and must be aligned exactly opposite the toolbit.

Once the setup has been made, the operator can locate the tool by means of the peg and sleeve, which is grooved externally to correspond to the internal recesses desired. If the depth of cut is not critical, the follower can be reversed 180° and adjusted to ride in the groove on the opposite side of the tool—thus providing a depth indication as well. *H. Moore, Leeds, England.*

Layout Key Simplifies Cam Location

GEARS, HUBS AND CAMS that must align in a definite way with keys that hold them can be marked with the aid of this partial key, which is set in the keyway after the part is in place.

The major height is the same as the full height of the required key, and the minor height is enough to bring the key up flush with the edge of the shaft at the keyway. The end of the hub, cam or gear can be scribed with the key as a reference after it has been aligned, and then the part can be removed and machined out for the proper key. *M. H. Ball, Watervliet, N. Y.*



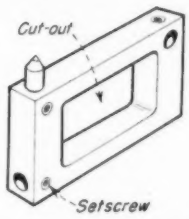
Felt Pads Simplify Shaper Clamping

THE AVERAGE TOOLMAKER, because he doesn't have three hands, has trouble with hold-downs on shaper setups when he is closing the vise. A layer of felt can be glued to the underside of each hold-down to raise them off the parallels and yet provide a soft cushion which will not interfere with clamping action. *Chris Sorenson, Racine, Wis.*

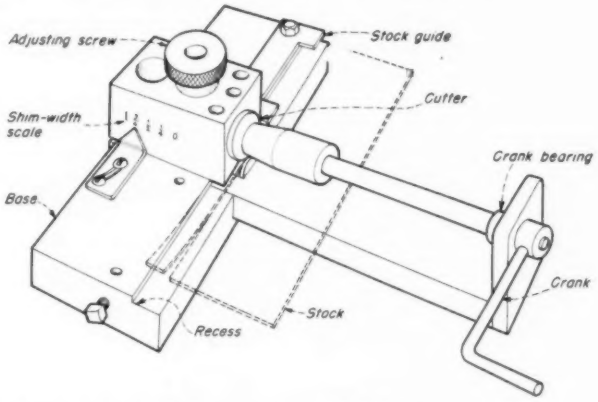
Light Holder Speeds Dressing

GRINDING WHEELS can be dressed quickly with a hollowed-out block that mounts a diamond dresser in any one of three positions.

A steel block, 6 in. by 3 in. by 1 in., is milled out in the center. Three holes, which are slip fits for the dresser, are drilled in three different faces of the block, and holes for socket-head setscrews are drilled and tapped to intersect the large holes.



The milled-out center lightens the holder, and also provides an easy grip for the machinist. On grinding jobs where a large amount of stock must be removed, and the wheel must be shaped often, the machinist can mount the block on a level portion of a jig or fixture to smooth off the wheel. This eliminates cranking the wheel up or down into an awkward position for dressing with a diamond in a fixed position. *Joseph Z. Madaras, Fairfield, Conn.*

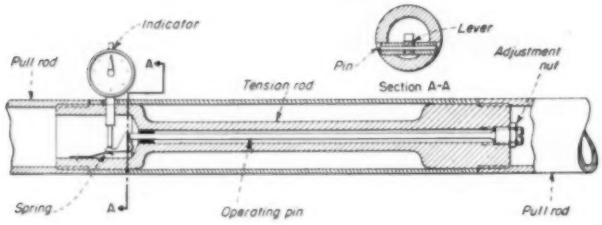


Shim Cutter Gages Widths

STOCK from 0.002 in. up to about 0.035 in. can be cut accurately, to uniform widths and perfectly square, with this cutter. Two circular cutters, one inside the base and one on top, do the shearing.

Shim-width adjustment is made by loosening the binder screw in the plate, moving the plate until the pointer indicates the required shim width, and resetting the screw. Dowel pins through the head seat in the base and control alignment of the two parts when the plate is adjusted. Hold-downs can be attached at both front and rear of the plate to guide the stock.

A knurled clamp handle in the head controls the vertical pressure between the cutters, which allows for various thicknesses. *J. A. Raught, Racine, Wis.*

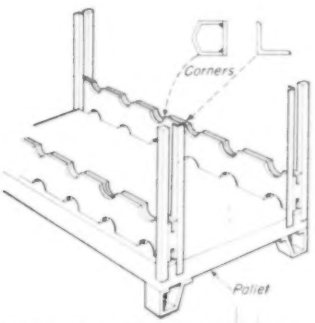


Tension Rod and Indicator Gage Broaching Force

WE HAVE an old 10-ton gun-rifling machine on which we had to do some broaching not long ago. In order to have a check on the broaching force we devised a gage which utilized a dial indicator.

The rod was 10 in. long and had a ⅞-in. OD. It was bored so a smaller rod could be pushed through it. The rod was mounted between two sections of the broaching pull rod by means of threads on each end. Thus, the tension rod was subjected to all the tension of the pull rod, and it was elongated slightly under load.

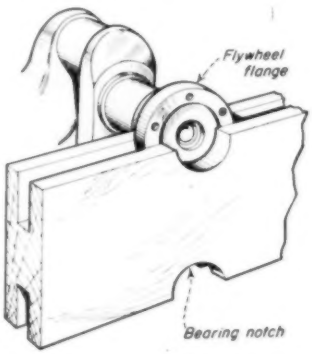
The smaller rod was fixed to one end only of the tension rod, and the other end contacted a lever, fixed to the tension rod, and a dial indicator. The relative motion, under load, between the indicator rod and the tension rod produced a dial reading, which, after calibration, was an accurate load-gaging indication. The lever was constructed so that one revolution of the dial indicator would indicate a full-load rating of 10 tons. *A. Vetsch, Steffisburg, Switzerland.*



Collapsible Pallet Assemblies Store Engine Crankshafts

MATERIALS HANDLING at Oldsmobile's Kettering engine plant was worked out even before machinery was installed so parts brought in from other plants could be handled on pallets. Assembly areas are bordered by spaces where special pallets can be stored temporarily.

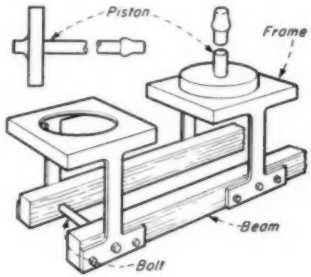
Pallets that carry "Rocket" engine crankshafts are fitted with angle- and channel-iron corners which confine cut-out boards (2x8 in.). Six boards per pallet hold 18 crankshafts by their main bearings so they do not touch each other. Each board is slotted on each edge to allow the flywheel flanges to be held. Notches in both top and bottom edges of the boards allow stacking the shafts three rows high with no interference.



Corner posts and boards can be removed when the pallets are emptied so storage space for empties is minimized. *Chester S. Ricker, Grosse Pointe, Mich.*

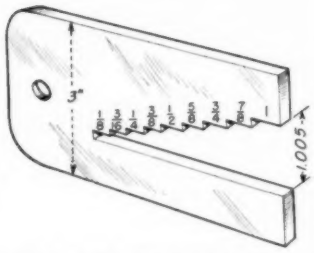
Special Racks Store Locomotive Replacements

Two of the most difficult parts to stock in a locomotive shop are steam pipes and mounted pistons. These both have awkward shapes and are large.



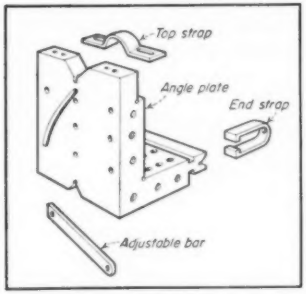
The pipes are stored on vertical racks in the yard. These racks are made from standard I-beams, welded together, and mounted in concrete pillars. This arrangement keeps them upright so they take a minimum of room and are easily accessible.

Mounted pistons are stacked on sheet-steel frames held together by 4-by-8 beams. The frames are cut out in the center to admit the peaked heads. Pistons are also positioned on the beams between the metal frames. *Thos. H. Duffy, Altoona, Pa.*



Stock Gage Indicates Size

ROUGH CHECKS on sheet-stock sizes can be made with a handy gage that is easy to make in quantity. It is made from ¼-in. tool steel, about 3 in. wide and 5 in. long. Steps in the slot are milled to standard gage widths, and the plate is stamped with the dimensions. To allow for burrs, each step is milled about 0.005 in. oversize. *Roger Isetts, Kenosha, Wis.*

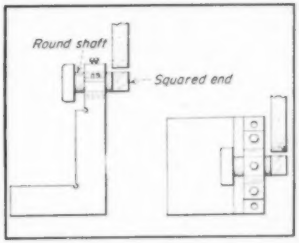


Special Angle Plate Features Adjustable Bar

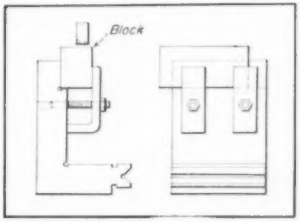
A VARIETY of toolroom work can be done on this angle plate which is made with precision, and preferably in pairs, so accurate machining can be done.

The plate is drilled and tapped in many places for clamping setups, and an angle bar is pivoted at a bolt through the long face and clamped on a curved slot cut at a 2¾-in. radius from the pivot. The vertical face is 5 in. high and the base is 3½ in. square.

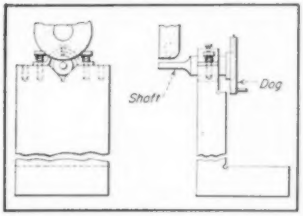
Three V-cuts are made accurately for setting up cylindrical work, and clamps are provided to fit the cuts. The adjustable bar is 3⅜x⅝x¼ in. *Allan B. Nixon, Springfield, Mass.*



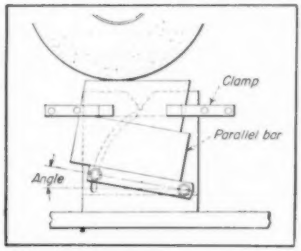
Squared-off end on round shaft is ground by clamping shaft in V and adjusting position of plate so sides are ground square



Rectangular block is squared off by clamping it in notch on vertical face of plate. Tapped holes allow bolting clamp to plate



Short shaft is finish-ground in 90° V-cut. Dog clamped to end of shaft permits turning when shaft is clamped barely snug



Angled work is ground with setup on adjustable bar. Short work is brought up over plate with parallel bar, clamped tightly

$25 *In addition to regular payment*

for the best PRACTICAL IDEA

An extra payment of **$25** will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

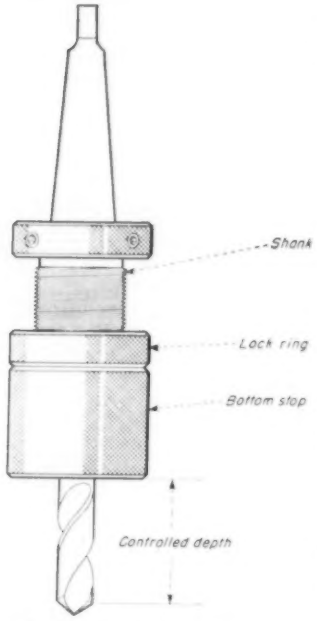
REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

75th Winner:

C. R. MILNER
Finish-Forming
Cutter



Drill Stop Controls Hole Depth to Four Thousandths

FINE DEPTH adjustment is controlled with this drilling stop which is locked to the lower end of the drill shank by three setscrews.

The stop is built of three parts: a threaded shank which contains the setscrews, a lock ring, and a hardened bottom stop. The ring locks against the bottom stop after the depth has been set.

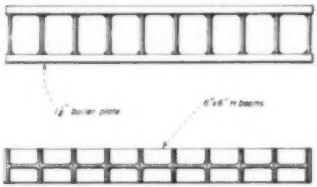
Accuracy to 0.004 in., plus or minus, can be held if the thread (20 tpi.) is accurately cut and the fits are fairly close. The stop is used in conjunction with a quick-change chuck on jobs with holes of different depth. *N. Bownass, Stevenage, Herts, England.*

Split Fixture Clamped With Chuck Jaws

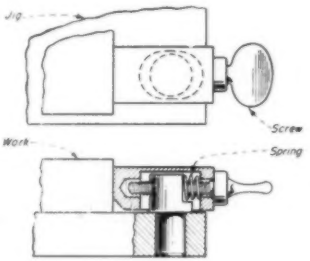
WHILE the method outlined by Mr. Isetts in "Engine-Lathe Fixture Holds Washers for Boring" is perfectly satisfactory, I have discovered that any jig or fixture involving the use of capscrews, setscrews or sockethead screws is not openly accepted by operators as handy.

Therefore, instead of clamping washers with clips, we chucked and bored a piece of round stock just as Mr. Isetts has done. This was then split by sawing, replaced in the lathe, and parts were mounted by operating the chuck jaws to clamp the sections of round on the washers.

This proved satisfactory because the only motion required for loading the parts was through the use of a chuck wrench. *R. J. Thomas, Cherokee, Iowa.*



After quite a bit of experience with solid and welded reinforced steel, we found that this type of back-up spacer for a bulldozer was about ideal. It is light and rigid for its weight, and will not bend under full bulldozer load. *W. A. Court, Memphis, Tenn.*

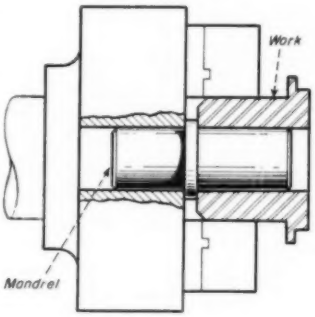


Work Pusher Holds Alignment

A WORK PUSHER and locator which can exert considerable pressure and which will not mar the work is illustrated. It is an assembly including a body, a pin, and a screw, with a spring to provide back pressure.

The pin is drilled and tapped through the head horizontally to take the screw, which works in clearance holes in the body. The milled-out section of the body is machined to allow travel of the body over the pin, but is not milled through to prevent chips getting in to interfere with the screw.

Shoulders on the screw, which work in the holes in the body, keep the pusher aligned, and the spring keeps the screw bearing against the body. *Victor Ritz and Robert Mery, Farmingdale, L. I.*



Soft Mandrel Centers Parts

A BORE and two turned outside surfaces on a lot of castings we made had to be concentric within a thousandth. The first operation was to rough and finish bore the 3-in. inside diameter and turn the smaller outside diameter. To make sure that the 10-in. diameter was turned concentric with the other two cuts on the second operation, a mandrel was turned to slip inside the bore.

This mandrel was cut to fit the spindle nose of the lathe, and projected a few inches out inside the chuck jaws. The jaws were turned to the 8-in. diameter, and the work was assembled in the chuck. Both jaws and arbor were soft steel.

A total of 500 parts was turned out rapidly and within the dimensional requirements. *Fred H. Lingenfelder, Milwaukee, Wis.*

Drilled and tapped holes are burred with a tool made by buttwelding a countersink to a bent ½-in. rod. *Roger Isetts, Kenosha, Wis.*

"Give us the tools . . ."

The 81st Congress Can Halt the Administration's *SOCIALIST PROGRAM*

In his speech at Massachusetts Institute of Technology, Winston Churchill said that America's possession of the atomic bomb is all that has kept Soviet Russia from overrunning Europe and bombing London.

Our State Department knows that there has been another deterrent to aggressive warfare by Russia and a deciding one. That deterrent is the superior industrial strength of the United States. But once Russia approaches our industrial strength, then watch out! For Stalin or no Stalin, there will be trouble. Therefore, the simple table below is worth every American's careful reading. It shows in percentages what Russia did with her national income in 1948 and what we did with ours:

	USSR	USA
Civilian use	60%	79%
New capital equipment and public works	21%	12%
Foreign aid		2%
Defense	13%	5%
Building of inventories and war stock-piling	6%	2%

These figures for Russia come from *The* (London) *Economist*, Britain's influential economic journal.

These figures are estimates based on information from behind the Iron Curtain, and so cannot be checked directly. But they fit with what is known of Russian development.

The table shows that Russia is straining every resource to build up its industrial strength. When Russia's effort is measured in *dollars*, and compared to ours, the figures show:

Where we spent $20 to $21 billion for new industrial plants and equipment last year, the Russians spent $12 to $14 billion.

But while we used about $9 billion of this to *replace* old equipment, the Russians spent no more than $2 billion for replacing old equipment. The Russians had much less worn-out and obsolete equipment to replace. They could concentrate their efforts on expanding their industries and buying new equipment.

So—we used only $11 to $12 billion to *expand* our industries.

And the Russians used almost as much to expand theirs—$10 to $12 billion.

Russia is gaining industrial strength as fast as we are—and may soon be gaining faster. The more she gains and the faster she gains on us, the greater is the danger of war.

continued on next page

American industry is pushing modernization and expansion hard. It is doing an heroic job. McGraw-Hill's recent survey* shows that *industry* already has in hand plans to build plants and buy equipment in the next five years adding up to $55 billion. Industry plans that investment—*and much more—if it can get the money.*

On those plans of *industry* depend *our* national security.

If these plans of ours are cut back, the Russians will be years closer to their goal of industrial equality—the strength that they need to wage aggressive war successfully.

But more and more our industry's plans are being menaced by socialist policies in Washington. The President continues to urge a further increase in the tax on corporate profits, even though federal taxes alone now take 38 cents of every dollar of profit. He wants $3 billion more in taxes on corporate profits now, plus added personal taxes.

Last year corporations spent almost two-thirds of their profits—about $13 billion—for new plant and equipment. This year corporation profits will be lower than last year's $21 billion, perhaps by 20 per cent. Subtract a fifth or more from last year's profits. Then adopt the President's proposal and take $3 billion more in corporate taxes and you raise havoc with planned expenditures for new plant and equipment.

Approval by Congress of the President's tax program would cut industry's program of plant and equipment development by a third or more. That means a major blow to our prosperity as well as our national security. For as capital investment goes, so goes general prosperity.

Further serious damage would be done by Congressional approval of the President's industry-control bill. The so-called Stability Act of 1949 (the Spence Bill) would severely check industrial progress. That bill would put the federal government in the business of providing the added industrial capacity which the tax program would prevent private industry from doing for itself. It would be hard to conceive a better and surer way to dry up private investment in new plant and equipment. For every dollar of government investment will scare away many times more dollars of private investment. People will not want to risk their money in businesses competing with the U. S. Treasury. At the same time it will attack private investment in another way. It means that government would spend your income for you instead of allowing you to spend or invest for yourself. That is the high and quick road to socialism.

American industry needs right now great courage and incentives if it is to carry out its tremendous building program. It needs also a release from the program of a socialist administration in Washington with its systematic discouragement of enterprise and risk taking.

Above all, industry needs assurance by the actions of the 81st Congress itself that there is a future in this country for a system of dynamic capitalism, functioning in a free society. By acting now to strengthen the American people's faith in their industrial system, by providing needed incentives for management and investors, by protecting industry's capacity to buy new equipment, the 81st Congress can sustain American industrial progress and keep us united and strong.

But if we kill freedom of industrial planning and action by unneeded taxes and government controls we put ourselves—and our friends all over the world—in dire peril.

Nothing would please the Communists more.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

***A complete report on our national survey may be obtained by writing McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y. This is one of a special series of editorials on industry's needs for new plants and equipment.**

NEWS OF METALWORKING

New Business Index Introduced At Industrial Supply Convention

CLEVELAND—The opportunity for exhibitors and distributors to see and talk with members of top management at a convention, and a new business index which may prove to be the most sensitive indication of changes in business trends—these were two striking features of the Triple Industrial Supply Convention held here Apr. 25-27 by three associations—the American Supply and Machinery Manufacturers, the National Supply and Machinery Distributors, and the Southern Supply and Machinery Distributors.

No Machines to Demonstrate

Exhibitors had no displays as such. Instead, comfortably fitted booths were staffed with one of top management men from the company arranging the booth. Literature was available but no gadgets, no machines to demonstrate. Distributors were almost certain to find a representative with authority at the booth during the three day session, for a discussion of plans and problems rather than a demonstration of products.

Reason for this type is partially a product of the times. What with flush money gone, transportation charges for machines and special displays being costly, and the high rates charged at conventions by local craftsmen for setting up and dismantling the ordinary type exhibit made the conference type exhibit sensible. That it was productive is proven by the enthusiasm voiced by both exhibitors and the highly specialized persons attending. Only criticism voiced was by an exhibitor who saw, in the absence of factory officials who attend such gatherings for a look at new products and applications, a loss of potential business.

The new business index revealed at the convention by a research committee of the American association represents a compilation of monthly orders received by 134 companies making tools, rubber goods, steel, machinery and power plant supplies purchased by more than 15,000 industrial users throughout the country. It is a sample of such new orders for producers of more than $1 billion worth of goods annually.

Beats FRB Report by 60 Days

The index appears to forecast changes in business trends 60 days before such changes are reported by the Federal Reserve Board durable goods index, it was said. The index is particularly valuable to manufacturers as an aid to estimates of future production requirements, for scheduling work output and product production schedules in plants, it was explained.

Keynote theme of convention sessions was "how to improve sales and service to reduce distribution costs. It was pointed out that many distributors have studied their operations during the last year and are revising their sales territories to get back to their natural trading areas, after expanding geographically in coverage during the war.

K. R. Beardslee, vice president, Carboloy Co., Detroit, was elected president of the American Association for the coming year, succeeding James G. Geddes. The National Association elected Ray C. Neal of R. C. Neal Co., Buffalo, N. Y., president, and Harold E. Torrell of Syracuse Supply Co., Syracuse, N. Y.; J. H. Ruddell of the Central Rubber and Supply Co., Indianapolis, Ind., and William A. Haseltine of J. E. Haseltine & Co., Portland, Ore., vice presidents.

ECA Shipments About 1/6 of Authorizations

WASHINGTON—Actual ECA shipments of machine tools and metalworking machinery totaled against procurement authorizations will give manufacturers a better idea of why orders seem slow coming in.

With a first-year total of $79.8 million in procurement authorizations issued for machine tools and metalworking machinery, only $11.9 million had been actually shipped and delivered. Of this $7 million was machine tools and $4.9 million, metalworking machinery.

ECA, last month, came up with its first procurement authorization for U. S. metalworking machinery to be delivered to Korea. It was a small one, though, just $16,000. This was out of machinery and equipment total of $524,000, most of which was for electrical motors and generators. Almost $24 million in procurement authorizations have so far been issued to Korea, newest country to come under ECA's wing.

***NEW CHART** based on new order-bookings by members of American Supply & Machinery Manufacturers' Association anticipates business turns one month ahead of Federal Reserve Board Index. The study was proposed by Chester Conner (left), manager industrial sales, B. F. Goodrich Co., Akron, shown here with the new Association President K. R Beardslee, vice president of Carboloy Co., and J. G. Geddes, retiring president.*

Air Force Armament Lags Behind Planes; Shortage of Money and Men

By BLAINE STUBBLEFIELD

WASHINGTON—Air Forces armament is the shooting end of combat aviation but its development is more than a year behind that of airplanes.

There are several reasons for this reversal. Manpower and funds are lacking for armament because the airplane has all the glamour. Development of bombs and guns and fire control is backstage drudgery.

Armament is not only the warhead of aviation; it is a bigger job than either airframe or power plants. The armament system of a modern bomber costs about 45% of the total.

While "in being" airframe and aircraft power plant industries are strongly supported the armament industries are obliged to deploy their skills in other fields. Neither the President nor Congress, in their air policy reports, recommended any armament programs.

What Engineers Would Like to Do

Here are some things the engineers would like to know and do if they had the men and the money:

Thoroughly test War II bombs from the 40,000-foot level.

Thoroughly test the new bombers, not just as flying machines, but as bombers.

Begin long-range research to learn the right shapes for bombs to be launched at higher speeds and altitudes.

One important next step is precision recording instrumentation to control the plane on its target run. This equipment will cost perhaps $100,000,000 to develop.

The old battle between procurement and manufacturer goes on as usual, with reason on both sides. AF engineers' story is that builders often decline to test bomb racks, releases, doors—saying it is not their responsibility. It goes back to the old urge to meet schedules and see airplanes flying. When the releases or doors don't work, back go the planes for modification, at huge extra cost. That goes for fuel tanks, navigation and communications equipment, instruments, wiring.

Must Build Planes Around Armament

A basic gunnery system must be varied for different types of airplanes. Each variation is slow and costly. Armament is still fitted into the plane. The time has come for airplanes to be built around their armament.

Major guns for both bombers and fighters are still the .50 caliber and the 20 mm, smallest gun that throws an explosive shell. An interservice committee, headed by various university research professors, is seeking to determine whether better results can be obtained from other bore sizes.

AF Guns from Ordnance

Ordnance produces all guns for AF, with its own funds. On July 1, AF will begin transferring funds to Ordnance for its guns, ammunition, and other items. Contention between AF and Army Ordnance for control of guns, shells, missiles, seems to have been minimized for the present.

Air Force is interested in development of light-metal cartridge cases, which would give an important reduction from present weight of steel (which probably will be accepted) and brass. Light-metal linkage is just as desirable, and more feasible. Ejected shells and linkage both are retained in the aircraft, so they won't hit following planes, and are usually carried back to base.

Even more desirable would be a shell case made of combustible material. One of the many problems might be acid corrosion of breech and bore. A bright idea, on which no prediction is safe, is liquid ammunition injection, like that of piston engines. One problem would be the slowing of action, or injection against back pressure.

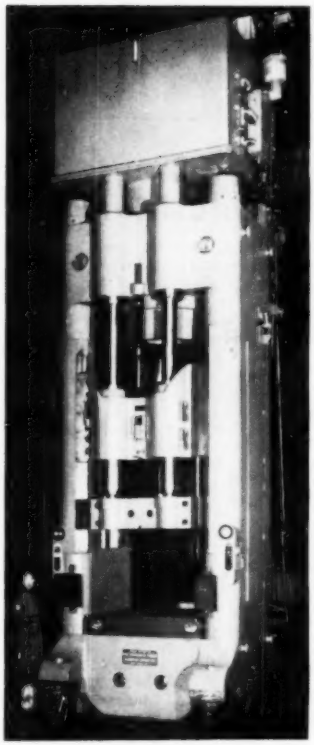
Difficult Armament Problem

Of all armament problems, fire control with its optic and radar intricacies, is most difficult.

More than 90% of all fire control research and development, and all production, is done under private contract, including a number of colleges in lab work. Private establishments far outbid the armed forces in salaries. Business-minded service engineers admit that private incentive produces the best results.

Air Force officers have privately talked about asking Congress for a government laboratory to conduct long-range research on air armament, as the National Advisory Committee for Aeronautics does on aircraft and power plants. Apparently no official request is imminent.

The private opinion of many Air Force officers is that while unmanned air weapons are being readied for the future, any early war must be fought with airplanes. Their problem is mainly a shortage of money and men. The solution, they believe, is recognition by Congress and upper defense levels, that bombs and guns are the front half of present combat aviation.



HYDRAULIC PRESS, *designed and built by The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, for export to France, can draw sheet metal parts to 24-in. depth. Dies up to 72 sq in. can be installed. This giant 2000-ton double action press is one of largest all-hydraulic units ever built for export*

India Lifts Restrictions On Imports of Tractors

BOMBAY, India (McGraw-Hill World News)—Officially committed to a program of food self-sufficiency within three years, the Indian government is letting down the bars which so far have restricted tractor imports. The tractors are desperately needed, for the food program calls for the reclamation of more than 800,000 of cultivable wasteland.

Tractor import licenses covering both dollar and soft currency areas are to be issued "liberally," therefore, subject to the following basic limitations: Only diesel or kerosene-powered units will be allowed; no unit having less than 10 hp at the drawbar will be allowed; American tractors must have "Nebraska Test" certificates, others must have government approval of specifications.

***THE MAGNESIUM ASSOCIATION** at a Chicago meeting of the board of directors last month elected new officers for 1949-1950: H. B. Megill of Dominion Magnesium, Ltd., Toronto, vice president (left); A. W. Winston of Dow Chemical Co., Midland, Mich., president; and R. D. Ferguson, of Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., treasurer*

Time Study Conference Stresses Effective Use of Working Force

NEW YORK—As man-hours are a major element of cost, methods of securing an effective utilization of the working force are one of the most necessary and fruitful tasks of management today, industrial executives were told at the fourth annual Time Study and Methods Conference held recently at the Hotel Statler.

Pointing out the wisdom of such a course, Gerald J. Doyle, directing editor of the labor department for the Research Institute of America, warned that, "Labor cost has pushed break-even points to dangerously high levels and made virtually every company more vulnerable than ever before to declines of volume or prices."

In attempts at cost reduction management will find standards to be of considerable help. Standards are measures of performance and permit recording improvements in work methods.

H. T. Hallowell, vice president and general manager, Standard Pressed Steel Co., stressing the importance of industrial engineering to management, warned against waste in all forms, including waste of capital. The speaker noted that the interest on one million dollars is only the wages of 10 humans and urged his hearers to find out what everyone on the payroll is doing to increase productivity.

Other speakers dealt with such aspects of time study as union participation, training of supervisors, rating, fatigue allowances, and human problems.

The Conference is jointly sponsored by the Society for Advancement of Management and the Management Division of the American Society of Mechanical Engineers.

Claim South Is Best Tool Market

ATLANTA, Ga.—Metalworking machinery and equipment manufacturers look to the South as offering the greatest sales market of any section of the country. This view was expressed at the close of the fourth Southern Machinery and Metals Exposition held here April 25-28.

Thousands of industrial executives and engineers were in attendance.

Addressing a session at the exposition, Charles M. Clark, assistant to the general sales manager of Cincinnati Milling and Grinding Machines, Inc., expressed the opinion of many that the South offers an unexplored market for machine tools.

Hamilton Migel, vice-president and eastern manager of Magnaflux Corp., Chicago, said that selective inspection will greatly increase efficiency in metal manufacture.

Discussing industrial management and plant relations, Robert S. Lynch, president of Atlantic Steel Co., Atlanta, said that the key to efficient operations centered around the selection, training and promotion of supervisors. This was seconded by Stevens H. Hammond, president of the Whiting Corp., Harvey, Ill., who discussed employee and community relations. He said that industry must extend its programs to the community through its employees.

A great variety of new products and equipment was shown for the first time.

Materials Handling Developments Surprise Many Industrial Heads

NEW YORK—A large majority of business and industrial executives are unacquainted with current developments in materials handling equipment despite the fact that materials handling is one of the few fields in which cost reduction can be accomplished, it appeared from a study of the third Materials Handling Exposition held in Philadelphia in January. A survey of visitors to that show revealed 86.6% found equipment displayed which was valuable to their company but which they had not known about before.

This study was made by the research firm of Elmo Roper for Clapp & Poliak, Inc., New York, exposition management firm, and the American Society of Mechanical Engineers.

Ninety-five percent of the visitors said they found equipment at the show of value to their companies. Seventy-four percent say they plan to buy equipment as a direct result of the show. Yet only 5% said they went to the show with the idea of looking at specific plant equipment.

Of the attendance, representatives from the metals industry totaled 9.2%; machinery manufacturers, 8%; electrical products, 7.4%; automotive and aircraft, 5.8%; railroad operation and equipment, 2.5%; transportation, 2.1%.

Of those coming to see a particular type or piece of equipment (54.1% of the total), interest was divided as follows: Trackless carriers (including fork or lift trucks, pallet handling equipment, accessories, tractors and other trackless carriers) 59.4%; conveyors, bulk handling equipment, 31.8%; pallets, 13.9%; storage equipment, 10.1%; hoisting equipment (cranes, hoists and others) 9.8%; elevators, 8.6%; shipping and packaging machinery, 5.5%; overhead carriers, monorails, etc., 4.9%; conveyor accessories, mixing, weighing, sorting equipment, 3.6%; bridges, ramps, dock board, 1.6%; floor maintenance equipment, 1.2%; skids, 1%; equipment for special needs, 7%; all others, 8.4%.

First Models of New Auto Due

SAN DIEGO, Calif. — Production models of the new $1,170 Del Mar automobile will be off the assembly line before June 1, Arthur Cooksey, chairman of the board of Del Mar Motors, Inc., has announced.

The company has leased for 5 years 432,000 sq ft of factory space in a war surplus plant formerly occupied by Consolidated Vultee Aircraft Corp. Materials and parts were being assembled at the plant early in April for the first 100 cars, to be turned out late in May. Cooksey said that in the month immediately following initial production 1,000 cars will be produced and the number will be sharply increased afterwards.

The announced specifications show the Del Mar will be bigger than a "small" car and smaller than the conventional automobile. It will be powered by a Continental Red Seal 63-hp engine, have a 100-in. wheelbase and a 58-in. tread. Speeds up to 80 mph are claimed possible and 30 miles to the gallon of gasoline.

Continental motors had started to come into the assembly plant in April. Negotiations were then being concluded with the automotive division of Douglas Aircraft Corp. to supply the first 100 steel bodies. Some wheels and tires for the 100 had appeared.

Cooksey reported that negotiations are in progress which would establish Del Mar plants either in the old Cunningham plant in Rochester, N. Y., or the Brill plant in Philadelphia; another in the Chicago area and one in Ft. Worth. Plans for other plants in France and Argentina are also being made, he said.

The first 100 cars to be made are to be of the sedan type and have steel bodies. Later production is to offer buyers a choice between steel and plastic bodies, and convertible models. Pittsburgh Plate Glass Co. would establish a San Diego plant, Cooksey said, to make the laminated fiberglas plastic bodies. He also said that Continental Motors and the Star Radiator Co. were planning branch plants in the San Diego area to supply the Del Mar requirements.

Resistance Welding Institute Organized

CLEVELAND—Establishment of The Resistance Welding Institute, an educational organization for the dissemination of information on technical advances in resistance welding, has been announced. Lee H. Judge has been named director of the Institute, with headquarters in Cleveland.

***SHERR COMPARATOL** used for measuring Pratt & Whitney airplane motor valve guides is being examined at New York University College of Engineering's $150,000 Ordnance Gage Laboratory: Prof. W. A. MacGrehan, director of the laboratory, (left); W. E. Bramer, chief inspector, John A. Roebling's Sons Co.; Paul Rhudy, methods engineer, E. I. DuPont; Frank Antalec, chief inspector, Bates Mfg. Co. The occasion was an April session of the Round Table on Quality Control.*

Machine Tool Expansion Due to Earnings Plowed Back, Forum Told

BUFFALO—Most of the expansion in the machine tool industry over the years "has come from earnings plowed back to increase capacity," Tell Berna, general manager of the National Machine Tool Builders Association, stated at the 13th annual Westinghouse Machine Tool Electrification Forum held here April 26 and 27.

Urging that the public be sold the free enterprise system, Mr. Berna pointed out that while some Americans are indifferent to the miracles made possible by the use of production machines in their own country, other nations are not. "They not only scrape up all of the precious dollars they can to buy American machine tools," he said, "but they pay us the sincere compliment of doing everything they can to imitate us—by building up their own machine tool industries as fast as they can."

Technical Papers Presented

The forum program included a number of technical papers prepared by electrical and development engineers employed by machine tool companies and by Westinghouse engineers, as well as a tour of the Buffalo Division's plant of Westinghouse.

Magnetic clutch spindle drives for turret lathes were described in a paper presented by L. A. Liefer, electrical engineer, Gisholt Machine Co. He reported that magnetic clutches and combination clutch-and-brake units have been used successfully in applications requiring smooth, shockless acceleration and deceleration, and described an application of a combination unit on a turret lathe tooled for machining rope grooves in sheaves.

High-Frequency Motor Use

Use of high-frequency electric motors, from 500 to 2500 cycles per second, for driving small internal grinder spindles was described by Leroy B. Morrill, electrical engineer, Heald Machine Co.

Of interest was a paper on the use of bonded resistance wire strain gages as components of machinery and gaging equipment by George N. Levesque, development engineer, Brown & Sharpe Mfg. Co.

Induction hardening of machined ways on 8000-lb frame castings for Cecostamp hammers, using "hairpin" and "pancake" type radio-frequency heating coils, and the hardening of piston rings and the ends of piston rods was described in papers delivered by R. L. Alcorn, Jr., mechanical engineer, Chambersburg Engineering Co., and D. G. Hatchard of Westinghouse Electric Corp.'s Industrial Electronics Division.

High-point of each day's session was an open-forum discussion of daily problems encountered by electrical engineers in machine tool plants.

***JIGGLING HARROW** cuts giant crosswise slice from end of iron ore stack of Geneva Steel Co., Geneva, Utah. Each "slice" contains a part of every layer previously stacked lengthwise by twin mechanical boom (left background), thus blending the ore to make it more uniform for charging into blast furnaces. Harrow loosens a slice of ore, letting it fall into trough (where man is standing); plows mix it further and push it on to a traveling hopper. Thence it is conveyed by belt to the screening station and separated into three sizes.*

Auto Industry Steps Up Research on Devices for More Mileage per Gallon

WASHINGTON — Long-range prospects of high prices and taxes on gasoline are causing the automobile industry to step up its efforts on devices to give more mileage per gallon.

Promising among several possibilities to get more mileage is a transmission that would keep the car in a gear ratio that will permit the engine to run at well-open throttle. This line of development, Bureau engineers said, might boost present mileage by three-to-one, or to about 60 miles per gallon.

Open throttle is far more efficient than part throttle. At crack opening, parasite load (friction and compression resistance) absorbs a large part of the total power output. For example, roughly, mechanical efficiency at crack throttle might be 33%, compared with around 80% with the air intake well open.

The desired automatically variable ratio transmission could be a mechanical gear, perhaps with planetary features. Or, the desired result might be obtained more economically with a variable hydraulic arrangement.

The overdrive now in use is a step in the direction of open throttle driving. A transmission that would permit moderate car speed at open throttle must range up to a very high wheels-to-engine gear ratio.

Mileage-stretching transmissions will be feasible when their cost can be offset by fuel savings.

The Bureau of Standards, though it might on further study disagree with some of his figures, cites several gas-saving proposals made by William S. James in a paper before SAE. Mr. James said that reduction of heat loss and incomplete combustion could add 15% to current mileage; small engines (less power) 16%; 12 to 1 compression, 30%; supercharging, 17%; automatic transmission, 37%, etc.

$401.1 Million in ECA Machinery Authorizations

By the end of March ECA had issued procurement authorizations for some $401.1-million of machinery and equipment, $384.3-million of that coming from the U. S. Four European countries received 77% of this; France, $113.5-million; Italy, $771.-million; United Kingdom, $76-million; Netherlands, $43.4-million. The 12 other Marshall Plan countries split the balance.

"JANMAT" Dies; Work Goes On

WASHINGTON—The name "JANMAT" dies on June 30. The work of the program will continue, however.

The Secretary of Defense last month ordered the JANMAT committee inactivated. Policy decisions were transferred to the Munitions Board and the ground work handed out to the Navy Department.

Reason for the reorganization is that the program has slowed down appreciably. JANMAT's original goal of 182,361 tools probably never will be attained. Best guess now is that between 125,000 and 135,000 tools eventually will be tagged, shipped, preserved and stored for a future emergency. At present 103,000 tools have been shipped to storage, and another 5,000 are awaiting shipment.

For a while, early last year, acquisitions of tools were running around 6,000 a week. In the past few months acquisitions have dropped to around 700 a month. This is explained by the fact that the War Assets Administration source of surplus tools has been virtually cleaned out. The only remaining source of surplus tools now is the leased or unsold WAA plants which have not been cannibalized for scrap or tools.

Study Cites Labor Peace at Sharon

SHARON, Pa.—For a collective bargaining relationship to be healthy and stable, all parties involved—workers, owners, management, customers, suppliers, public—all must share equitably in its benefits, and just that has happened at Sharon Steel Corp.

That is the conclusion of the National Planning Association in the fifth in a series of studies on the "causes of industrial peace under collective bargaining."

The study analyzes Sharon Steel's 12 years of bargaining with the CIO's United Steelworkers.

Except for the nationwide 1946 steel strike, there has not been a single strike or work stoppage at Sharon Steel plants.

The study attributes this favorable labor situation to "external" and "internal" causes.

"External" causes, those beyond control of company or union: (1) high demand that has existed for steel since 1939 and (2) "Pattern" bargaining in the steel industry.

Among the "internal" causes: (1) Lack of bitterness or strife in signing the first contract; (2) effective consultation between both sides; (3) management's flexibility, as well as its firmness; (4) its encouragement of a strong union; (5) high caliber of union leadership.

Detroit

RETOOLING SEEN FOR HIGHER COMPRESSION RATIOS . . . NEW BUSINESS IF SHORT WHEELBASE CARS CATCH ON . . . LOWER PRICES MAY BE NEEDED

When machine tool and equipment makers look over the long-term automotive picture these days, they can take some heart from the problem which is growing up to face car makers using in-line 8-cylinder engines—the problem of adaptability to higher octane gasolines.

These longer in-line engines (and, almost to a similar extent, the 6-cylinder in-lines) do not have the rugged inflexibility which seems to be required for the higher compression ratios which go with the premium gasolines. Olds had to change from its 8-cylinder engine to a V-8, and Cadillac found the V type the only practical approach to the high compression powerplant.

Buick, Packard, Hudson, Chrysler, and others use 8-cylinder in-lines today. Some of them, notably Buick, seem to be about at the top limit of their practical ratios right now, and will have to be retooled if they are to reach higher. Wiseacres figure that Buick may be taking such a step before too long, and Packard may follow before too long afterward—even though Packard retooled its engine after the war ended, that company apparently had in mind the expectation that another new job might have to be engineered by the early 1950's.

The solution for 6-cylinder in-line plants is less apparent. There is talk of both V-6's and pancake 6's. The smaller cars powered with 6-cylinder engines, of course, will be among the last to switch over to higher compression type engines, so that problem can wait for a time.

Watch Shorter-Wheelbase Cars

The equipment makers, too, are looking with high interest on the introduction of shorter-wheelbase, stripped-down cars by Dodge and Plymouth, wondering whether these may presage an industry trend which would create some new tooling business.

Dodge has gone into production on the 2-door sedan and roadster of its Wayfarer line. The roadster has a factory retail price at Detroit of $1,635, to which taxes must be added, bringing the delivered price to around $1,800. The Wayfarer 2-door sedan factory retail is $10 more. A 3-passenger coupe is yet to come.

Packard's new Golden Anniversary models, introduced early in May, made a dramatic debut, what with their new Ultramatic transmission. This drive is a full torque converter, using an infinitely variable converter for lower speeds up to 15 mph (or 55 mph, if the driver so wills it, by keeping the gas pedal down to the floor) and then switching automatically into a driving gear with ratio between that of normal high and overdrive. The results: Considerable flexibility, and economy said to be greater than in a car with orthodox geared transmission.

The equipment manufacturers, eying this job carefully, pondered that this might be the way the others still in development would go. They were intrigued with the fact that the Packard's driving and driven wheels come out of sand castings, lending considerable flexibility to any forthcoming engineering improvements. The reasoning is that sand castings would not have been used if there was any thinking that the design is fixed—and any design changes in the future, of course, will involve new tools to do the job.

Ultramatics at 40 an Hour

Packard, incidentally, is tooled in its new transmission plant to produce 40 an hour of the Ultramatics. As soon as this level is reached, machines will be moved from other transmission departments into the new $7 million layout to make possible further expansion of output.

Packard's prices confirmed the general downward movement. They run from $103 to $246 below those of comparable 1948 models, added to which is the fact that many of them include equipment which was classed last year as optional, at extra cost.

Reductions like these have been made possible by fairly general, though small, reductions in costs of components. Automobile company purchasers are hammering their vendors hard these days, driving down prices by those fractions of pennies which mount up so rapidly in automobile manufacture.

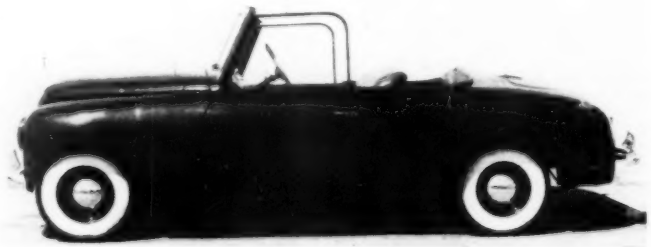
There is some ground for belief that since late last fall these minute reductions, added together, may come out to $50 or more per car. At least this holds true in a few of the more aggressive companies with on-their-toes purchasers. Those savings, coupled with the "shaking down" of production into routine performance, and with the amortization savings achieved by substantial production, can make possible such price tags as the new Packards are carrying.

Lower prices may prove necessary to maintain sales. The signs point to lowered purchasing power in Michigan. One example: Detroit toolshops are, on an average, barely exceeding a standard 40-hour week; what schedules there are which run into overtime are to be found almost exclusively in the biggest shops. Employment and hours worked have shown almost steady declines.

Employment Slump in Detroit

Another example: Manufacturing employment and payrolls throughout the state did little more than brace themselves as the turn was made into the spring upturn, and this bracing followed a winter in which the trend was distinctly down. And in Detroit the state Unemployment Compensation Commission remarked that with April "Detroit's economy entered the fourth month of what has become the area's most severe and prolonged employment slump since the war's end."

Construction, said the MUCC, is slow getting started; layoffs are coming in auto assembly plants; and machinery, manufacturing, foundries and forge shops pared 5,000 job holders from their work during March.



***THE DEL MAR** convertible, new automobile being produced by Del Mar Motors, Inc., San Diego, Calif. Production models of the new $1,170 car are scheduled to be off the assembly line before June 1. Continental Red Seal 63 hp engine will power the car at speeds up to 80 mph. (Story on Page 134)*

Names in the News

John G. Spruhan

John G. Spruhan has been appointed Central Div. sales manager of the Townsend Co., New Brighton, Pa. With headquarters in Detroit, he will coordinate activities of Detroit and Cleveland offices. Prior to joining Townsend, Mr. Spruhan was sales manager of the Monarch Governor Co., Detroit.

William Baumbeck, general superintendent of Rock Island Arsenal, Rock Island, Ill., is retiring from active duty after completing 45 years of government service at that installation.

Jack W. Crawford has been appointed manager of the newly created distributor sales division of Firth Sterling Steel & Carbide Corp., McKeesport, Pa.

Ralph J. Cordiner has been elected executive vice president and a director of General Electric Co., Schenectady, N. Y. He has been a vice president since Feb., 1945. He became assistant to the president in July, 1943, after serving during the war as director general of war production scheduling and vice chairman of the War Production Board.

Max M. Monroe has been appointed general manager of the Aeroproducts Div. of General Motors Corp. at Dayton, Ohio.

William H. Mitchell has been elected a director of Armco Steel Corp., Middletown, Ohio. **Frank H. Fanning** has been elected vice president, operations. **L. F. Reinartz** and **R. S. Gruver** have been named assistant vice presidents and **C. G. Davies,** administrative assistant, operations division.

Victor Ladetto has been appointed sales manager and **Donald H. Sleeper,** assistant sales manager, of The Continental Screw Co., New Bedford, Mass.

Arthur B. Cooper has been named assistant to vice president in charge of operations, Jessop Steel Co., Washington, Pa. Other appointments: **Edwin C. Thomas, Jr.,** general superintendent; **Benjamin H. Brown,** supt. of the electric furnace dept.

Robert T. Frisbie, Jr., has been appointed sales manager of the machine tool division of New Britain Machine Co., New Britain, Conn.

Theodore V. Houser and **J. F. Reis** have been elected directors of Kaiser-Frazer Corp., Willow Run, Mich.

Alan Carver has been named manager of the New York City branch office of Standard Tool Co., Cleveland. As reported in the May 5 issue of American Machinist, **Paul E. Lees** has been appointed vice president in charge of sales. Other appointments: **Joseph W. Bremer,** secretary-treasurer; **William S. O'Conner,** sales manager; **Elton Hoyt III,** assistant sales manager; **Lewis D. Fykse,** manager of service engineering; **Norman Duenk,** chief metallurgist.

J. H. Tredinnick

J. H. Tredinnick, manager of the E. W. Bliss Co.'s Hastings, Mich., plant, has been elected vice president of the company. He joined Bliss in 1935 to take charge of the Hastings plant. He earlier had been with the V & O Press Co., Hudson, N. Y., and Lanston Monotype Machine Co., Philadelphia.

A. W. Anderson has resigned as vice president of the Claud S. Gordon Co., Chicago, after 31 years with the company. He is a member of the Chicago Chapter of the American Society of Metals.

W. C. Osha has been named plant superintendent of the Dover, N. J., fabricating plant of L. O. Koven & Brother, Inc., Jersey City, N. J.

Robert H. Kitzman, manager of the Doehler-Jarvis Corp. plant in Toledo since 1943, has been elected vice president. **E. R. Zabriskie,** vice president and general sales manager, has been elected a director and appointed a member of the executive committee, with headquarters in New York.

Arthur B. Goetze has been named works manager of Western Electric Co.'s Tonawanda Plant in Buffalo, N. Y., the 42nd St. Shops in New York City, and the Allentown Plant in Allentown, Pa.

Ralph J. Cordiner

Paul E. Lees

Arthur B. Goetze

Business Items

Borg-Warner Corp., Chicago, is suspending operations of its Ingersoll Utility Unit Div. Cleanup of existing backlog orders will be completed early in June, at which time production at the division's plant in Evansville, Ind., will be discontinued.

Cleveland Cap Screw Co. will spend $500,000 in an improvement program to be completed by midsummer. $300,000 of this sum will be invested in a chemical and physical laboratory, the remainder for equipment.

Scully-Jones & Co., Chicago, has appointed the G. C. Wood Co., Pittsburgh, as its exclusive representative in the Pittsburgh area.

Tinnerman Products Co., Cleveland, has moved its New York district office from 620 Lexington Ave., New York, to 75 Roseville Ave., Newark. The company has opened a new sales branch office in Kalamazoo, Mich., at 212 Dewing Bldg., 132 North Burdick Ave.

Koppers Co., Inc., Pittsburgh, has contracted to purchase the Freyn Engineering Co., Chicago. The acquisition also will include the Open Hearth Combustion Co., a Freyn subsidiary.

Eaton Mfg. Co., Cleveland, will undertake a $2½ million expansion program at its valve plant in Battle Creek, Mich. The plant produces compressor blades for jet engines.

The Permanente Metals Corp., Newark, Ohio, in June will get production under way at the new Kaiser aluminum rod, bar, wire and cable mill here. The plant will have an annual capacity in excess of 1000 million pounds of electrical conductor material.

F. L. Jacobs Co., Detroit, has closed manufacturing operations at its Indianapolis and Louisville divisions, transferring these operations to its Detroit and Traverse City, Mich., plants.

Quality Castings Co., Orrville, Ohio, will start construction immediately on a new magnesium foundry at the North Main St. plant, hoping to complete construction within three months.

Hupp Corp., Cleveland, is expanding its lines at the Cleveland and Chicago plants, and will dispose of its Detroit plant. Contract machining being done at the Detroit plant will be done in the other two plants.

Columbia Steel Co. will discontinue production of commercial castings at its Pittsburg, Calif., plant by July 31. All present commercial commitments will be completed before suspension of foundry operations.

Obituary

John Wilson, 69, retired president of the National Steel Construction Co., Seattle, died Apr. 12. During World War I, he helped to found the Ames Shipbuilding & Drydock Co. After the war, he purchased the National Steel Construction Co., then a shipbuilding and repair yard and steel fabrication plant.

Clarence F. Wackman, 58, works manager and assistant secretary of Southern Metal Products Co., Houston, died Apr. 11.

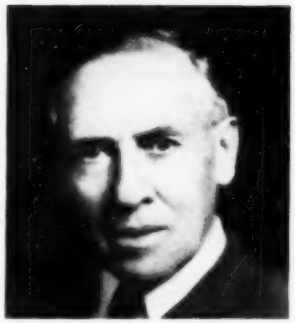
Charles E. Martindale, 80, superintendent of Main Machine Works, Ltd., Los Angeles, died Apr. 13.

E. Warner Bacon, 57, president of Erie Tool Works, Erie, Pa., died Apr. 8.

Curtis S. Garner, 73, former vice president of American Bridge Co., Pittsburgh, died Apr. 11. He had retired from the firm in 1945.

William P. Brown, 52, retired president of Briggs Mfg. Co., Detroit, died Apr. 25. He obtained his first job at the Briggs Detroit plant in 1920 as a mailing room clerk. In 1922 he became private secretary to Walter O. Briggs, was appointed vice president and general manager in 1933, and was named president in 1937. He retired in 1945 because of ill health.

C. Neal Barney, 73, vice president, secretary and general counsel of Worthington Pump & Machinery Corp., New York, died April 24. He joined Worthington as chief counsel and secretary in 1918, was appointed secretary-treasurer in 1932, and was elected vice president and secretary in 1942.



Eben J. Fullam

Eben J. Fullam, 78, chairman of the board of directors of The Fellows Gear Shaper Co., Springfield, Vt., died Apr. 26. He became associated with Fellows in 1898, was elected a director in 1916, and became the third president of the company in 1945, retiring from that position in 1948 to become chairman of the board. From 1931 to 1935 he was also president of the Bryant Chucking Grinder Co., Springfield. He has served as a director of the National Machine Tool Builders' Assn. During the past few years he had been a director of Vermont Foundries, Springfield.

Frederick W. Geisert, 58, owner of the Metal Products Mfg. Co., Seattle, died April 16. He was a member of the American Society of Tool Engineers.

William G. Bray, 63, assistant superintendent of the Harrison, N. J. plant of Otis Elevator Co., Yonkers, N. Y., died Apr. 25.

W. F. Wissman, 65, retired vice president, Motch & Merryweather Machinery Co., Cleveland, died Apr. 22.

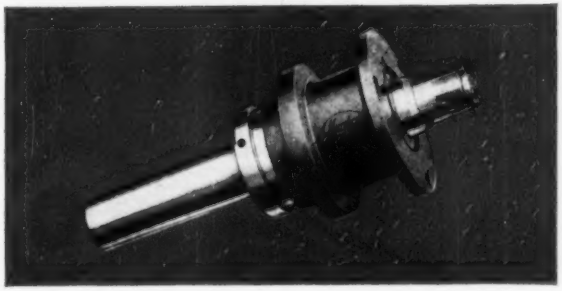
Eber C. Sherman, 60, president of Sherman Tractor & Equipment Co., Mt. Vernon, N. Y., died Apr. 22.

Col. Harry H. Stout, 76, former chief metallurgist for Phelps Dodge Copper Products Corp., New York, died Apr. 13.

***EXPANDED MANUFACTURING FACILITIES** are provided in this new Chrysler-Amplex plant at 65th and Harper Ave., Detroit. The plant contains latest equipment for larger production of Oilite heavy-duty oil cushion bearings, finished machine parts, filters, friction units and bar stocks. Production includes both ferrous and non-ferrous materials and alloys.*

MURCHEY COLLAPSIBLE MACHINE TAPS FOR

Speed, accuracy and economy



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A simple but accurate adjustment at shank end of body expands or retracts the chasers to exact pitch diameter. This adjustment can be made without removing the tool from the machine. Chaser size adjustment at shank end facilitates adjustment and increases service life. Chasers are positively retracted.

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The type "L" tap is highly flexible. Body and nose piece are separate. Two tools with separate nose pieces provide a threading range of 15 basic sizes from 1⅛" to 6" in diameter. The nose piece is detachable so that several sizes can be used on each tool body. The sealed nose excludes chips and dirt.

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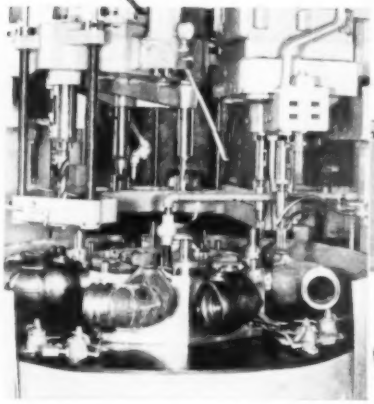

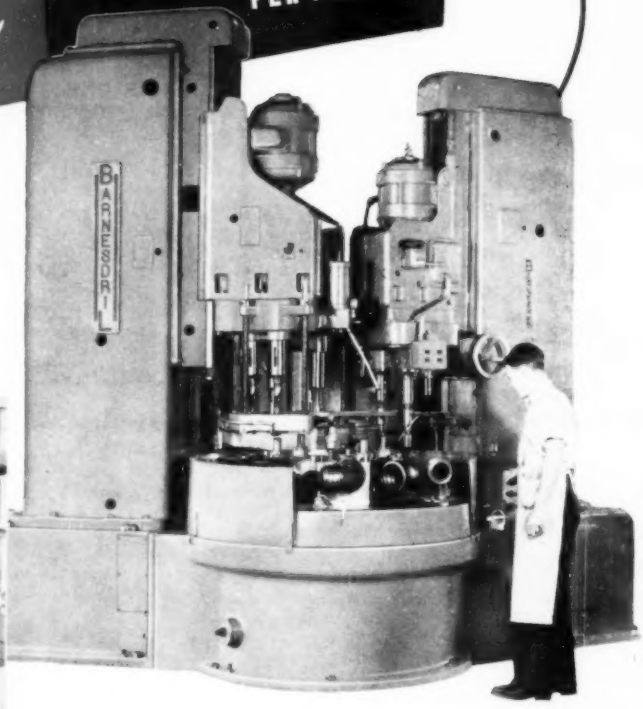

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Friction Bandsawing . . . I

COURTESY THE DO-ALL COMPANY

FRICTION circular sawing has been done by metal fabricators since the War of 1812, at least. Foundrymen have, for many years, speeded up ordinary bandsawing equipment. They noticed that when sparks flew from a bandsaw, considerably more cutting was done, without any appreciable extra wear of the blade for the work accomplished. When they increased surface speed of the saw, a dull blade would cut as much as six times as fast as a new blade at conventional speeds.

When World War II created huge demands for small parts, a "new" technique was developed — friction bandsawing. The technique, of course, turned out to be an adaptation of the foundrymen's method, and since then it has become an important shop process.

The "secret" of friction sawing lies in its employment of the heat of friction to a useful purpose. If a soft steel disk is turned at high speed on a lathe and a hardened toolbit brought up against the disk, excessive speed will result in a deep groove in the tool and very little change in the disk. That is, fundamentally, friction sawing. Transform the high surface speed of the disk periphery to the edge of a rapidly moving bandsaw blade and the result is friction bandsawing with decided advantages.

At the point of the contact between blade and work, the heat of friction is concentrated on the material to be severed faster than the material can absorb it. The rapid heat build-up causes the material to soften, after which it is removed by the "teeth" as "sparks." The teeth actually serve as small scoops, and the sparks are minute chips torn loose and oxidized. Temperatures generated at the contact surface are higher than red-heat, but below the melting temperatures—about 1600 to 1800 F.

A coolant is unnecessary because the high surface speeds employed, together with the small area of tooth contact, limit the time of contact between each individual tooth and the material to a fraction of a second—after which the blade is air-cooled before reentering the cut. Heat penetration in the work is negligible, even considering a slight increase with thicker materials. Skin hardening never exceeds 0.002 in. so this method solves many problems of distortion caused by heat generated in other forms of cutting off. Tolerances of ±0.005 in. are maintained without difficulty.

The friction bandsaw can do almost all the jobs of the circular saw (except cutting heavier structural members) and still handle a range of more delicate work. It is actually an extension of the conventional bandsaw, making available a variation of surface speeds from 50 sfpm to 15,000 sfpm. Materials not suited to one range of speeds can be cut with the other. Practically any material within the size limitation can be cut by one or the other machine. Certain plastic materials are most simply severed by a combination. Most circular friction cutting requires a coolant, which is eliminated in the bandsaw method. Either type of friction sawing cuts the material faster than any other process except shearing.

Power and feed pressure are directly proportional to the area being sawed. Blade speed must be constant while sufficient pressure is applied to generate heat faster than the material can absorb it. Pressure may be applied by hand, with weighted gravity feeds or by the use of hydraulic feed. The last, being smooth but variable, is most efficient. It is desirable for heavier sections, close tolerances or long production runs.

Speed of cutting, for a constant energy factor, varies inversely as the material temperature, being six times as fast for 1400 F as for 60 F steel. One point cannot be overemphasized: Speed must be sufficient to soften the material through its entire thickness, or results will suffer.

Proper tooth selection cannot be

Table I . . Saw Speed and Pitch for Material Thickness

STEELS—S.A.E.	SAW VELOCITY, FPM			SAW PITCH		
	⅛"-⅜" Thickness	⅜"-1½" Thickness	1½"-3½" Thickness	⅛"-⅜" Thickness	⅜"-1½" Thickness	1½"-3½" Thickness
Carbon Steel #1010-#1095	3000	5000	7000	18	14	10
Manganese Steel #T1330-#1350	3000	5000	7000	18	14	10
Free machining #X1112-#1340	3000	5000	7000	18	14	10
Nickel Steels #2015-#2515	3000	6000	9000	18	14	10
Nickel Chromium #3115-#3415	3000	6000	9000	18	14	10
Molybdenum Steel #4023-#4820	3000	6000	9000	18	14	10
Chromium Steels #5120-#5150	3000	6000	9000	18	14	10
Chromium Steels #51210-#52100	3000	6000	9000	18	14	10
Chromium Vanadium #6115-#6195	4000	7000	10,000	18	14	10
Tungsten Steel #7260-#71360	4000	7000	10,000	18	14	10
N. E. Steels #802-#8949	4000	7000	10,000	18	14	10
Silicon Manganese #9255-#9260	4000	7000	10,000	18	14	10
OTHER STEELS						
Armor plate	3000	5000	9000	18	14	10
Stainless Steel 18-8	3000	5000	9000	18	14	10
Illium	4000	7000	10,000	18	14	10
Cast Steel	3000	5000	9000	18	14	10
CAST IRONS						
Gray Cast Iron	3000	5000	7000	18	14	10
Malleable Cast Iron	3000	5000	7000	18	14	10
Meehanite Castings	3000	5000	7000	18	14	10

Speeds Welding 25% with Heavier Current

By DELBERT CRAVEN, Supt.
The Alliance Structural Co.
Alliance, Ohio

Delbert Craven

We fabricate many different types of cranes ranging up to 300 tons capacity. Most of these structures involve heavy, boxed-up sections on which arc blow seriously limited the amount of current and the welding speed that could be used. By installing 500-amp. AC "Fleetwelders" for this work, we have eliminated arc blow, and the operators are now able to boost their welding current from 300 to 385 amperes, resulting in 25% faster welding. Moreover, the welds are of higher quality and easier to make.

The crane girder shown in Fig. 1 is typical of the kind of weldment now being fabricated in our shop. The top and bottom plates are $\frac{7}{8}$" plate, fillet welded to $\frac{5}{16}$" side plates with large diameter $\frac{1}{4}$" "Fleetweld 7" electrodes. Many of the welds on this 85 ft. crane girder are single pass $\frac{5}{16}$" fillets requiring heavy sustained welding at high currents (Fig. 3).

Substantial savings in idle power losses are further helping to cut our costs on these jobs. Where the idle factor is high, such as leaving the welder connected to the line while fitting up parts, considerable cost savings are made since the "Fleetwelders" draw far less current from the line than the motor driven equipment formerly used.

A comparison of the all welded crane girder with similar size riveted designs shows a saving of 20% in weight. This weight saving is largely the result of eliminating connecting members and rivets by arc welding.

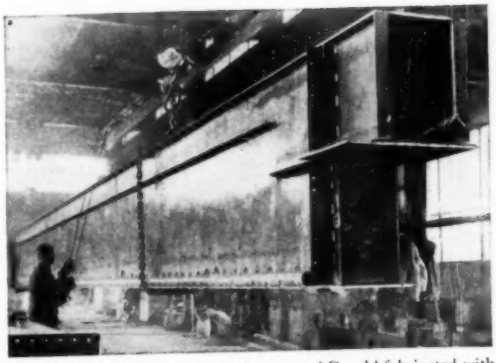


Fig. 1. Girder for 60-ton capacity crane AC weld fabricated with the new Lincoln "Fleetwelder." Top and bottom plates are $\frac{7}{8}$" steel . . . sides are $\frac{5}{16}$" plate. Girder is 85 ft. long, 76 in. high and 28 in. wide . . . weighs 20 tons.

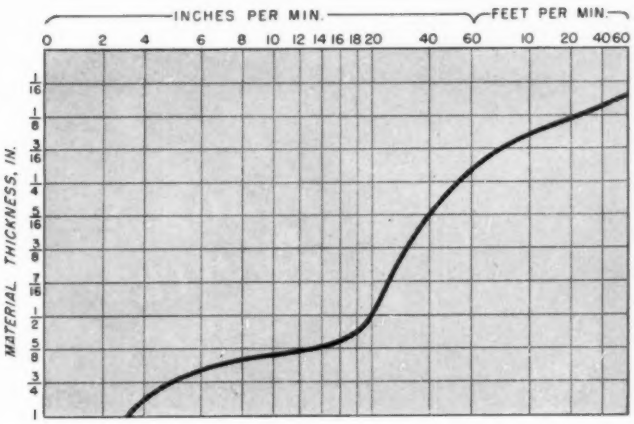
Fig. 2. Setting correct welding current with Continuous Current Control on the 500-amp. Lincoln "Fleetwelder" AC arc welder. "Fleetwelder" has exclusive "Arc Booster" that makes arc striking easy on all types of work.

Fig. 3. Fillet welding rope guard of 5" pipe to bottom plate with $\frac{1}{4}$" "Fleetweld 7" electrode and using 385 amps. welding current. Fillet welds are single pass $\frac{5}{16}$" continuous and intermittent.

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*
For further information on the "Fleetwelder," write for Bul. 366, The Lincoln Electric Company, Dept. 105, Cleveland 1, Ohio.

Friction Bandsawing...II

Linear Cutting Speeds for Carbon Steels



stressed too highly. The best blade for friction sawing has a uniform size and set—not the punched tooth or B-temper blade, but one with milled teeth with rather wide precision set and aligned in the manufacturing process. The A-temper precision blade commonly used in toolrooms is most suited to this purpose. Selection of proper tooth-spacing (pitch) is important. If teeth are spaced too far apart they tend to remove more material than is softened. If tooth spacing is too close, there is a tendency to load and bind. Friction saw teeth, unlike conventional saw teeth, need not be sharp. The dull blade creates increased friction, thus increasing cutting speed. A new blade will not cut efficiently until it has been used for about 20 minutes.

Equally important to satisfactory cutting is proper selection of blade speed. Speeds available run from 3,000 to 15,000 sfpm. Most cutting is satisfactorily accomplished between 5000 and 10,000; occasionally this may be reduced or increased for special operations. Overloading or overspeeding may break the blade.

Proper saw pitch and velocity for various materials up to ½-in. thick are given in Table I.

A thickness limitation of ½ in. is considered a safe maximum for the beginner. Thicknesses of 1 in. and over are now friction-cut with the same efficiency but require skill. Cutting rate is reduced on a comparative scale as thickness increases. Although it is necessary from the safety standpoint for industry to maintain size limitations, thicknesses up to 3 in. may be friction-sawed economically with a handling technique called "rocking." The thinner the work section presented to the saw, the faster and cleaner the cutting. Rocking the thicker sections so first the top edge, then the bottom edge, alternately strike the blade, and maintaining this motion until the work is severed, has the effect of feeding a thinner section at a time. However, thicknesses over 1½ in. should not be cut without a trained technician.

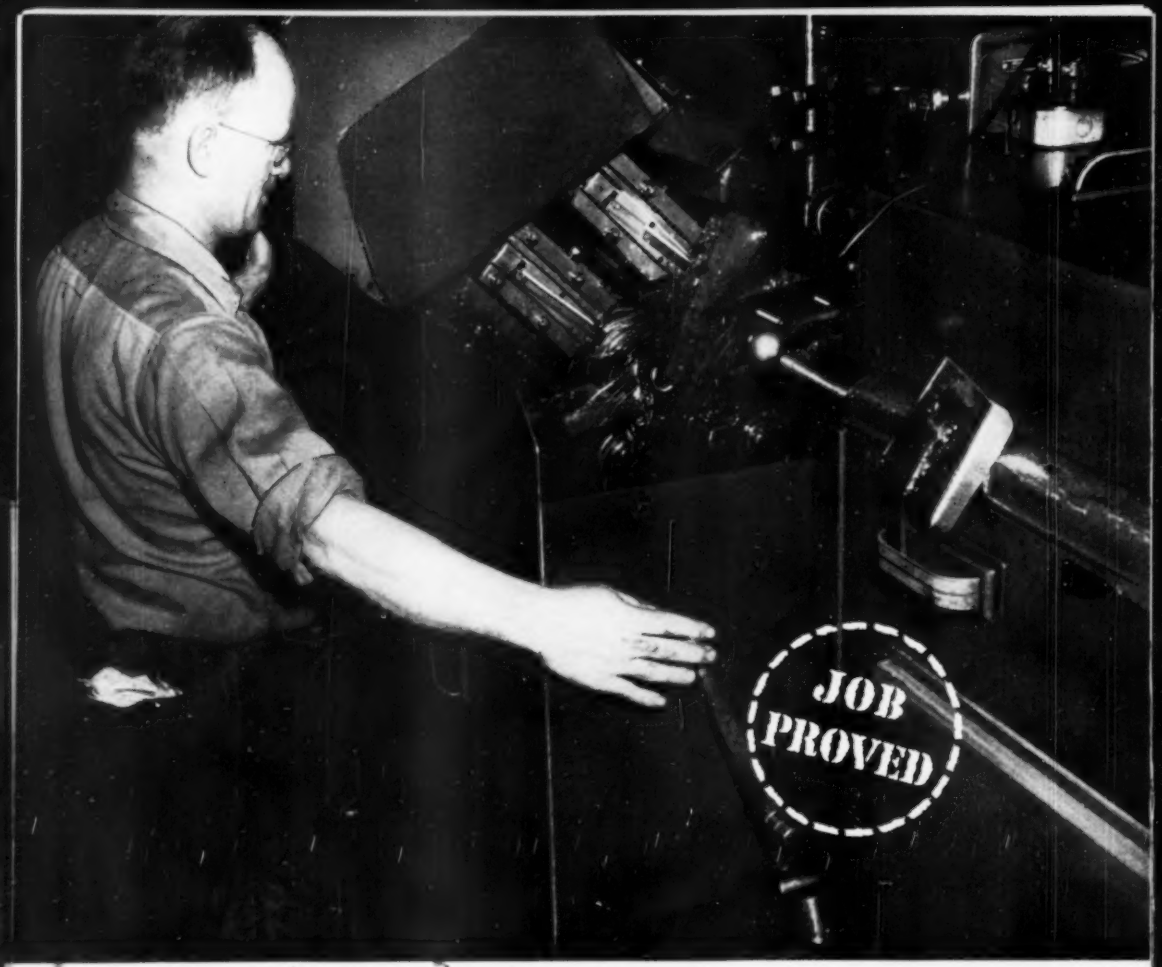
Steady feeding pressure is highly important. As pressure is applied to the material, there is considerable resistance, then as heat is built up in the work, the cutting action increases. When cutting action is smooth, feeding pressure is increased and held uniform until the cut is completed.

Steel and alloys with a melting point closely akin to the heat range of friction sawing have been most successfully cut by this process. Hardness is of no consequence as a control condition. Soft steel, alloy steel, armor plate, stainless steel, saw stock, springs—all are cut with ease. However, melting point of the material is a prime controlling factor. The carbides cannot be cut by friction sawing. Copper, zinc- and lead-base alloys do not handle well because they tend to braze to the blade. Plastics create a similar problem. A technique combining conventional and friction bandsawing is being utilized effectively for cutting certain plastics. Cutting of aluminum, magnesium, brass, Kirksite, etc., should be done on a conventional bandsaw at conventional speeds.

Table II..Maximum Thicknesses

FLAT STOCK		TUBING*	
Saw Width	Maximum Thickness	Diameter	Maximum Wall
1/4	1/8	1¼-1½	3/4
3/8	1/4	1¾	5/16
1/2	3/8	2	3/32
5/8	1/2	2¼	1/8
3/4	1/2	2½	7/64
1	1/2	3½-4½	5/64

*Saw widths listed at left apply to flat stock only. For tubing of 1½ in. O D, the maximum work thickness is approximately 1 in., and the use of a 1-in. 10-pitch saw would be indicated for the tubing sizes listed.



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American Machinist

Acme-Thread Measurement With Wires

BY J. S. ROJAHN, Threading Engineer, LANDIS MACHINE COMPANY

Measurement of the pitch diameter of Acme threads by means of wires is an operation in which the necessary calculations are not easily tabulated. Because wires of various diameters may be used with threads of the same pitch, and because the diameter-pitch combinations are often special, the number of possible situations is practically infinite. Even if only the standard diameter-pitch combinations are considered, the variation of the pitch diameter of the screw in the eight different classes of fits renders such tabulation impossible. Each problem must therefore be calculated separately and without benefit of an instant solution in tabular form.

The length of such computations is unimportant if the path to solution is defined clearly. In cases of this sort the complexity of the formula used and the amount of time required for its solution is directly proportional to the degree of accuracy required. Gage inspection, of course, requires more accuracy than the ordinary inspection of machine components.

The simplest formula is:

$$E = M + \frac{\cot a}{2\,n} - G\,(1 + \operatorname{cosec} a) \qquad (1)$$

Where:

E = pitch diameter
M = measurement over wires
a = one-half included angle of thread in an axial plane
n = number of threads per inch
G = diameter of wires

This formula is given on page 228 of the National Bureau of Standards Handbook H28-1944, but does not take into account the helix angle. Therefore, the formula should not be used in any calculation involving Acme threads, because the helix angle plays a very important part in the determination of the pitch diameter of these threads to even ordinary accuracy.

To take into account the effect of the helix angle, the above formula is expanded into:

$$E = M + \frac{\cot a}{2\,n} - G\,(1 + \operatorname{cosec} a + \frac{S^2}{2}\cos a \cot a) \qquad (2)$$

Here S is the tangent of the helix angle at the pitch diameter and the other notations are the same as for the previous formula. This formula is found on page 232 of Handbook H28 and is the one most commonly used for determining the pitch diameter of Acme threads. When the indicated trignometric functions are substituted, with $a = 14° 30'$, the above formula becomes:

$$E = M + \frac{1.93336}{n} - G\,(4.99393 + 1.87178S^2) \qquad (3)$$

This leaves for substitution the final measurement M, the number of threads per inch n and the diameter of the wires G.

The step-by-step solution is accomplished as follows:

1. Assume a pitch diameter approximately halfway between the maximum and minimum for the particular thread to be measured. The use of the basic pitch diameter as in Handbook H28 is not recommended, because in the new Acme standards the screw pitch diameter is always appreciably lower.

2. Using this assumed value for E, calculate the tangent of the helix angle by the formula,

$$\tan X = \frac{L}{\pi\,E}$$

Where X is the helix angle
L is the lead of the thread
$\pi = 3.141593$

3. Now substitute in the formula 3. Note that S is equal to the tan X just calculated.

4. If the calculated value of E is too far from the value assumed above, the process must be repeated, using the last calculated value of E for the assumed E in the next calculation. As an indication of how far these values may diverge, it is noted that a difference between assumed E and calculated E of 0.010 in. does not change the fourth decimal place of the calculated E if the helix angle is less than 8°. For larger helix angles, the difference is necessarily smaller.

Another formula, which has been devised by myself but which nevertheless is slightly more accurate than the above is,

$$E = M + \frac{1.93336}{n} + G\,(\frac{1}{\sin a'} + 1) \qquad (5)$$

Where:

a' = one-half the included angle of thread in a plane normal to the helix angle and the remaining notations are as before.

The step-by-step solution of this formula is:

1. Find the helix angle X exactly as above.
2. To find angle a', solve the formula:
$$\tan a' = \tan a \cos X \qquad (6)$$
3. Substitute in the formula (5) to find E.
4. The same considerations as noted above govern the repetition of the process.

Although both the formulas 3 and 5 are approximations, they are sufficiently accurate for practical purposes and may be used for any available wire size within the range permitted for a particular thread. They may also be used for both "general purpose" and "centralizing" Acme threads as well as for special diameter-pitch combinations. Results obtained by these formulas will differ from each other by about 0.0001 in. at a 12° helix angle and by about 0.0003 in. at a 16° helix angle. As noted above, formula (5) is the more accurate.

The "best" wire sizes listed in Handbook H28-1944 are not really the best, even if the helix angle should be ignored. The term is misleading because these sizes were calculated by using the basic pitch diameter which is not close to the actual pitch diameter of the screw.

Ed. Note: For references to calculation of other elements of Acme threads, see the Reference Book Sheet "Acme Thread Calculations" by J. S. Rojahn (*AM*-p. 139, Dec. 4, 1947). That RBS lists tables and page numbers for appropriate data in The National Bureau of Standards Handbook H28-1944.

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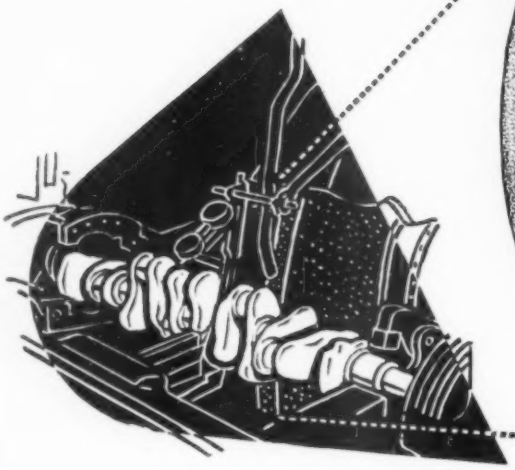

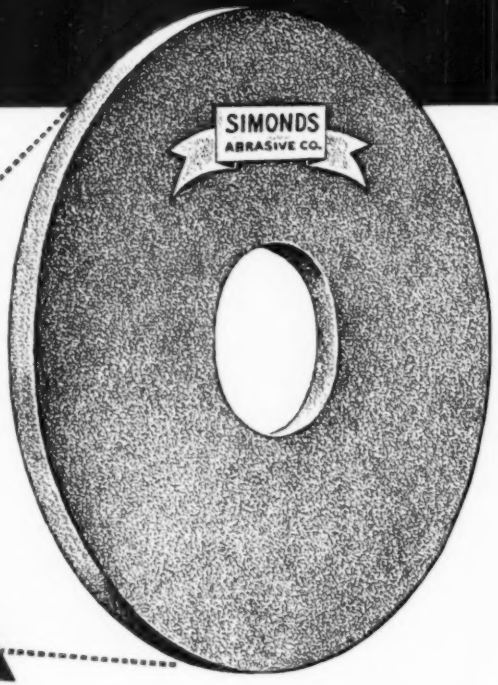

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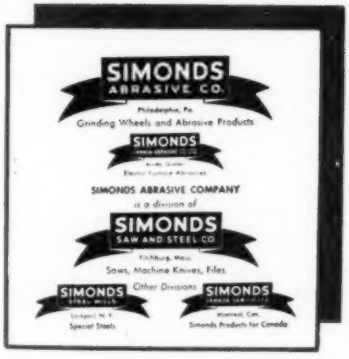

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TALKING SHOP

Gadget-Minded

"PEOPLE in the United States are so gadget minded they won't work long at a job without trying to rig up a gadget to speed up the job or do part of it for them." So says Edwin Daybell of K. & L. Steel Founders, Letchworth, England, one of a group of 16 visiting foundrymen. In part because of this liking for gadgets, the American worker can produce more than most British plant employees without exerting any more physical effort. Another factor favoring the American worker is his state of mind, which consists to a large extent of willingness to accept new ideas and methods . . . Or so think Daybell and compatriots.

Introduction

ANNIVERSARY BROCHURES are a dime a dozen. But we've just seen one with an unusual idea—that of introducing its field engineers (salesmen to you) and factory service specialists to its customers. Harrington-Wilson-Brown Company of New York, celebrating its 25th birthday, pictures 10 salesmen and six factory specialists and gives a short biography of each, then goes on into the more conventional picturing of the lines of machinery and machine tools it sells. The company has come a long way from the late twenties when we used to make a weekly call on Messrs. Wilson or Brown—or their mutual secretary—to find out what business was cooking locally.

New Broom

WITH ALL the publicity given by the uninformed to the workingman's desires for wage increases, there is danger that even the informed will forget that money is well down the list. Security is the prime consideration in the minds of most working people. And the most vulnerable group in this respect are the foremen. What are you doing to give them security?

If shop management changes, the operator is protected by his union, but who protects the foreman against the "new broom" upstairs? How about severance allowances, pensions and the like? If foremen are to consider themselves part of management, they should be shown similar consideration.

Good Will

NO LESS AN AUTHORITY than the U. S. Supreme Court defines "good will" as smart public relations. Here's the definition: "The disposition of a pleased customer to return to the place of business where he has been well treated."

Paradox

CAREFUL RESEARCH and cost comparisons usually precede selection of a brand of small tool. But once that is ended, management is frequently inclined to sit back and let the P. A. reorder "the same" whenever stocks go low. No effort worthy of the name is made to see that the tools receive proper care, are sharpened at proper intervals, held efficiently, stored properly. Tools vanish into vagrant toolboxes, or into scrap, and that's considered a "normal loss." What a paradox!

Such losses aren't normal, and aren't necessary. Closer inventorying and control can cut tool breakage and loss in half or better. In these cost-conscious days, here's a good place to hunt.

Parachute Tester

INSTEAD of dropping parachutes to test them, the Air Force is building at Muroc Air Base, Calif., a 120-ft. tower, about which parachutes will be whirled at speeds up to 500 mph. A 2800-hp., variable-frequency, synchronous, G.E. motor at the base will drive a vertical shaft at speeds ranging from 8.2 to 41.0 rpm. Variable frequencies will be obtained through an induction frequency-converter unit. Parachutes will be held in a nacelle until the arm at the tower top reaches desired speed.

Charity Begins at Home

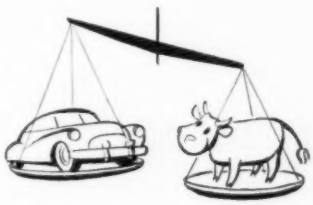
AMERICAN STANDARDS ASSOCIATION, prime exponent of standards in the U. S., has turned the searchlight inward and found—oh horrors!—that its own standards are published in some 20 different sizes. Of course this multiplicity results from the activities of the many national organizations active in the program, but something can be done about it. Hereafter there will be three standard sizes for standards—8½x11 in. for pamphlets, 6x9 in. for books and 5¼x7¾ in. for pocket-size books. Most standards will be in the largest size, for convenience in filing in standard filing equipment.

Torture

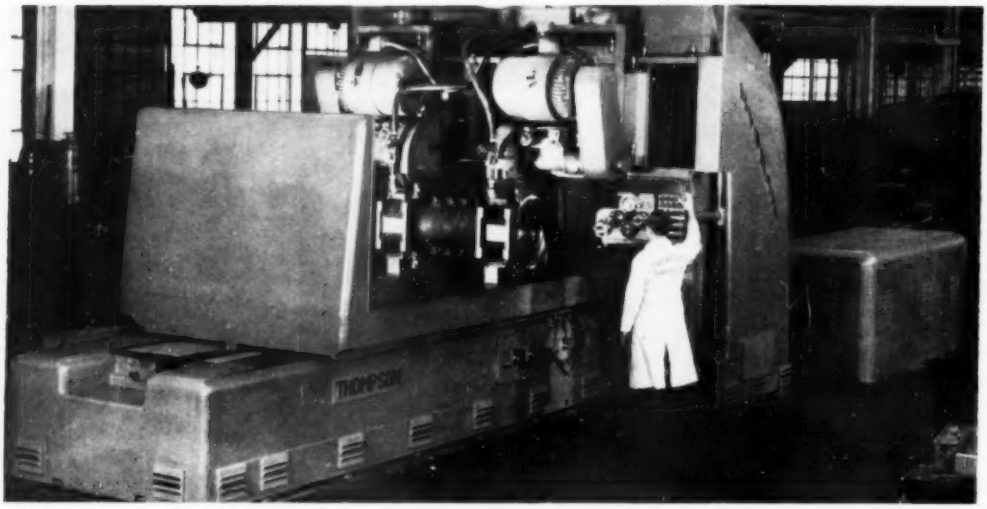
TO CHECK gear lubricants, Armour Research Foundation puts 'em in an auto differential, then throws in the clutch 15 times at 65 mph. This accelerates a dead engine to 3400 rpm practically instantaneously. After this, there are ten similar shocks in second gear. Through all that, the lubricant is supposed to protect the gears—a nice trick if it can be done.

Cars and Butter

CARS are really cheap today. That's what W. J. Davidson, executive engineer of General Motors, tried to tell us the other day. The new Chevrolet costs about 40 cents a pound, he says, and that is less than butter or steak by far. The contrast with other products of Metalworking is even more marked: Toasters are $4.00 a pound; vacuum cleaners, $4.50 a pound, and typewriters run over $5.00 a pound. "Why," he said, "They are practically giving automobiles away!" He put quite a lot of emphasis on the *practically*.



New Shop Equipment



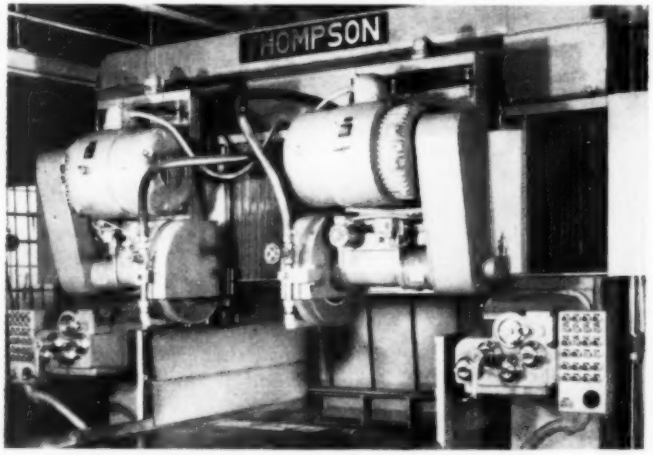
Two operators can work at this Thompson Hydrail surface grinder, each one controlling a wheelhead. The machine was built for grinding wear strips in the vertical guides of a diesel-engine anti-friction driving box

Hydrail Machines Surface Grind Bigger Work

Double-column surface grinders that mount either one or two wheelheads are now available for production and maintenance jobs on large work in the railroad, automotive, aircraft and other industries. Wheelheads are powered with 30 to 50 hp motors. Hydraulic table travel is infinitely variable from 10 to 100 fpm, wheelhead cross feeds range from $\frac{1}{8}$ to 6 ipm. The cross-rail can be raised or lowered by power at 15 ipm, but grinding feed is manually controlled in increments of one-half thousandth.

Although the double-housing grinder can be built with two wheelheads, both horizontal or one vertical and the other horizontal, the primary usage will undoubtedly be as a one-head machine. Formerly, the width limit with a single-column machine was presumed to be 36 in. Now, by introduction of the double-housing Hydrail, new fields for surface grinding are opened up. For example, large automotive dies can be sharpened without stripping down, and all die surfaces will be in correct relationship. And on new work, there is a possibility that finishing cuts formerly done on planers and milling machines will be handled on the grinder.

Hydrail grinders are built to specifications. The machine illus-



Both push-button and manual controls are available on both sides of the table. Small motor on wheel-spindle housing drives a pump that insures pressure lubrication of the spindle

Materials and Parts

trated is 35 ft long, 16 ft wide, 12 ft high, weighs 130,000 lb. It grinds to a tolerance of 0.0008 in. over its full capacity which is 75 in. wide by 10 ft. long by 36 in. high. Manual and automatic controls are available on both housings.

The two wheelheads on the illustrated machine are independent of each other for transverse and vertical feed in order to grind the hardened wear plates in the vertical guides of a diesel-engine antifriction driving box. It is possible to grind the wear strips in the sides and bottoms of both guides simultaneously, using two operators. The grinding time on this job takes two hours, as compared with three days by other methods.

All of the hydraulic mechanism is contained in a separate box-like unit for ease of maintenance. Power from this source is supplied to the table cylinders and to the hydraulic motor that operates the cross feed to the wheelheads.

Table travel and spindle rotation cannot occur until oil is under pressure in the respective lubricating systems. In each instance, the protective arrangement consists of a lubricant pump and a pressure relay switch at an appropriate point in the lubricant line. When pressure opens the relay, power is permitted to flow to the wheelhead motor or to the hydraulic-pump motor serving the table cylinders, as the case may be. By incorporating these protective systems in the machine, the spindles cannot operate with dry journals, or the table reciprocate on dry bed ways.

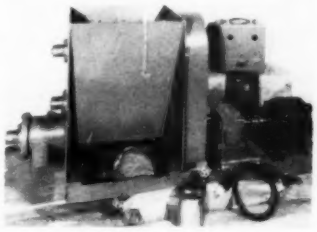
Spindle bearings are steel-backed, silver lined, for maximum service life. All bearings in the machine are completely protected from dirt and grit. Bellows-type covers protect the housing ways, belt-type covers are used over the bed ways. Wheelhead motors are of the totally-inclosed, fan-cooled type. The coolant sump is of 300-gal. capacity. Thirteen motors, totaling 100 hp, are incorporated in the machine.

Thompson Grinder Company, Springfield, Ohio.

Plate, Sheet, Machined Parts Offered in Carpenter Stainless

Carpenter Super - Corrosion - Resistant Stainless No. 20 is now being commercially produced in the forms of sheet and plate. Stainless No. 20 sheet is produced in standard widths and lengths, and gages from 24 to 11, while plate is being produced in thicknesses from 3/16 in. up. Precision parts, illustrated, such as valve trim and many types of fastenings, are also available in Carpenter Stainless No. 20.

The Carpenter Steel Company, Reading, Pa.



Automatic-Control Dry Feeder Regulates Chemical Solutions

The Robot Chemist automatically feeds dry chemical compounds to washing and cleaning solutions. Adjustment of a dial serves to regulate the concentration of washing and cleaning solutions. Electrical conductivity varying with approaching exhaustion serves as true and simple measure of controlling concentration.

The strength of the solution in the wash and cleaning tanks is maintained accurately. It represents certain electrical and radio principles including the wheatstone bridge which maintains laboratory-grade accuracy regardless of line voltage and other vari-

...INCLUDING

Milling machine for gears and pinions has table actuated by air and cam combination....page 150

Stamping presses have heavy plate construction to provide press rigidity.....page 151

Bench shaper has ram stroke to 7 in., cutting speed 3 to 114 fpm. For toolroom and production operation .....page 152

Horizontal bandsaw maintains line of cut parallel to bed as saw frame descends. Will stop at preset depth of cut.....page 156

Automatic brazing machine silver-brazes eleven joints by radiant gas heat on brass sub-assemblies. 540 units per hour.....page 160

Milling table is ball-mounted to tilt 30° in any direction. Base calibrated 360°.....page 162

Steel furnished in cold-finished bars for screw machines has machinability index of 170..page 164

Portable grinder has rubber drum inflated at low pressure to hold abrasive band.....page 166

New Bulletins for your shop library — after page 232

...and in JUNE 2

Gear hobber produces spur, spiral, and bevel gears to 6-in. dia. Speed, feed, and indexing are independently selected.

Second-operation machine adds air-operated collet, foot controlled, which holds work without distortion.

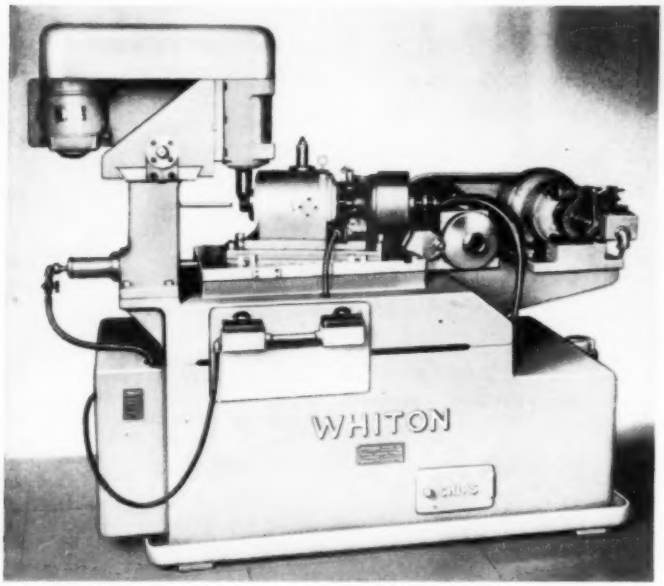
External hone is fitted with guide block and stone holder to suit diameter of work. Stones are available for roughing, finishing, and polishing.

ations. A Magic Eye serves as an indicator of bridge balances.

The main control dial provides the percentage of concentration in terms of pH equivalent directly in parts per million of sodium chloride, through electrical resistance and conductance, associated with rectifier and amplifier tubes. Connected with the instrument is a plastic cell, placed in a receptacle containing the actual solution to be checked. Solution is constantly running through the receptacle from the solution tank provided.

The washing solution is maintained in the solution receptacle by bleeding the pump line, thereby constantly sampling. When the strength falls below the setting called for, dry compound is automatically fed in the tank until the solution is brought up to the strength set on the instrument, thereby feeding all materials uniformly, and freeing the operator of this chore.

Precision Instrument & Control Company, 1828 Columbus Road, Cleveland 13, Ohio.



Special-Purpose Milling Machine Offered for High-Production Work

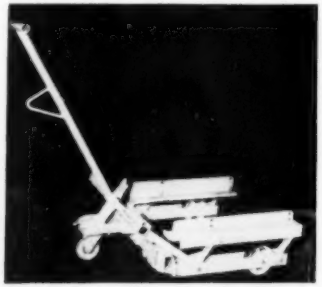
The special-purpose high-production milling machine, primarily designed for cutting bevel and spur gears and pinions, can perform many more milling operations. Any work requiring one or more slots milled on the face or outside diameter, work requiring hex, square or more sides to be milled, can be handled.

Machine has a vertical spindle mounted in anti-friction bearings, and individually motor driven through V-belts which allows the use of carbide cutters when available. The spindle unit is adjustable both horizontally and vertically. The table is of rigid proportions on hardened and ground ways and is actuated by a combination of air and cam to impart the proper rapid advance to and from the cutting position and to produce the proper feed for the cut.

Attached to the table is a spindle and a housing capable of swiveling to mill any angle up to 90°. Spindle indexing to suit the work is accomplished by means of index plates activated and locked into position by an air cylinder. Work is normally held in the spindle through the action of a collet operated by a rotating air cylinder. Upon completion of the operation, work is automatically ejected into a chute.

The high-production milling machine takes work up to a capacity of 8 in. in diameter. Speed using high-speed cutters is 125 sfpm. With high-speed steel cutters the feed is 0.003 per tooth, variable to suit the work.

The Whiton Machine Co., New London, Conn.



Lyon-Raymond Tote Pan Lift Truck Offers Two-Way Adjustment

A tote-pan lift truck is adjustable in width and lowered height. This two-way adjustment allows it to be used with practically all standard tote pans, ranging in width from 8 to 24 in. Truck width is adjusted by loosening eight setscrews and contracting or expanding the telescopic frame as required. The lowered height is changed by raising or lowering the side plates which are fastened by four bolts.

Two styles are offered: a narrow model designed to handle tote pans from 8 to 16 in. wide, and a wide model designed to carry pans ranging in width from 16 to 24 in. Height of the lifting forks can be adjusted from 2½ to 7½ in. The forks which lift and carry the pans are 22 in. long. Loads up to 1000 lb can be elevated by a single downward movement of the towing handle. The forks automatically lock in the raised position and are released by a pedal arrangement.

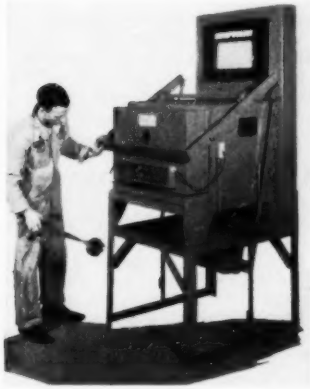
Lyon Raymond Corporation, 1202 Madison St., Greene, N. Y.

Super Tool's Core Drill Has Wear Strips Brazed on Flutes

An improved-design core drill offers strips of wear-resistant metal brazed on the entire length of the

flutes. Addition of these strips eliminates the abrasive wear from cast-iron chips on the body of the drill behind the carbide and eliminates loading conditions which score the finished hole. Result is increased core-drill life and superior hole finish.

Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.



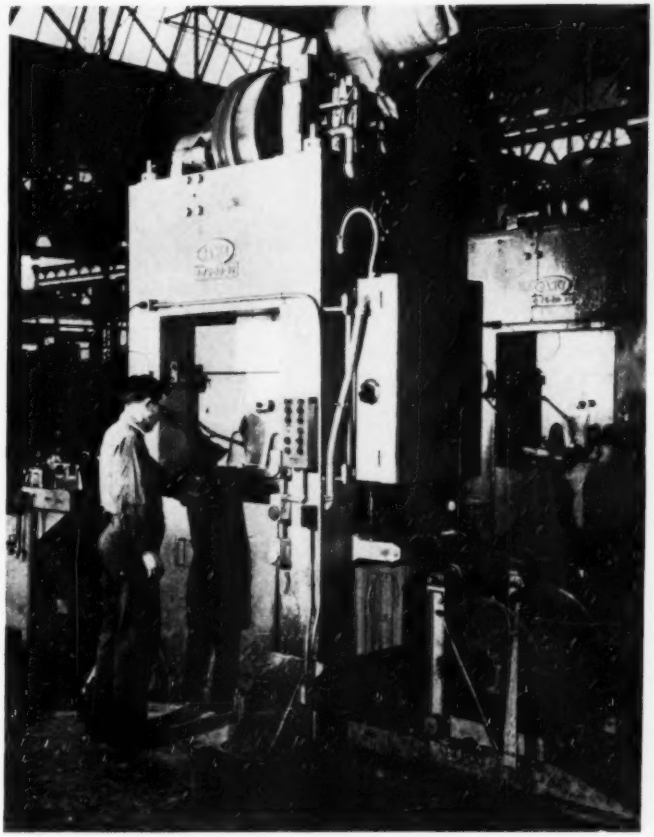
Box Furnaces Feature Resistors Embeddeed in Ceramic Slabs

A series of industrial box furnaces embodies resistors embedded in ceramic slabs. In the side wall they are so placed that an air space is left behind, above, and below the slab which then forms a baffle wall creating a natural convection when heated.

This arrangement not only equalizes furnace temperatures but causes cool operation of the element and furnace wall, the effect being to develop rapid heating, uniformity of chamber temperatures, and economy in operation. A door completely covers the operating end of the furnace. It insulates the front section equally with the other furnace wall. This type of door eliminates the need for heavy fire brick in the vestibule and door, eliminating most of the front-end heat losses.

Cooley Model BL-1, 2, and 3 industrial box furnaces are supplied in three sizes. Chamber dimensions, 12x7 in. high, are common to all three models. Respective lengths are 18, 24, and 36 in. with power inputs of 11.5, 14 and 18 kw. They are built for maximum heating temperatures of 1850 F and are offered for either single-phase or three-phase 230-v operation.

Cooley Electric Mfg. Corp., 38 South Shelby St., Indianapolis, Ind.



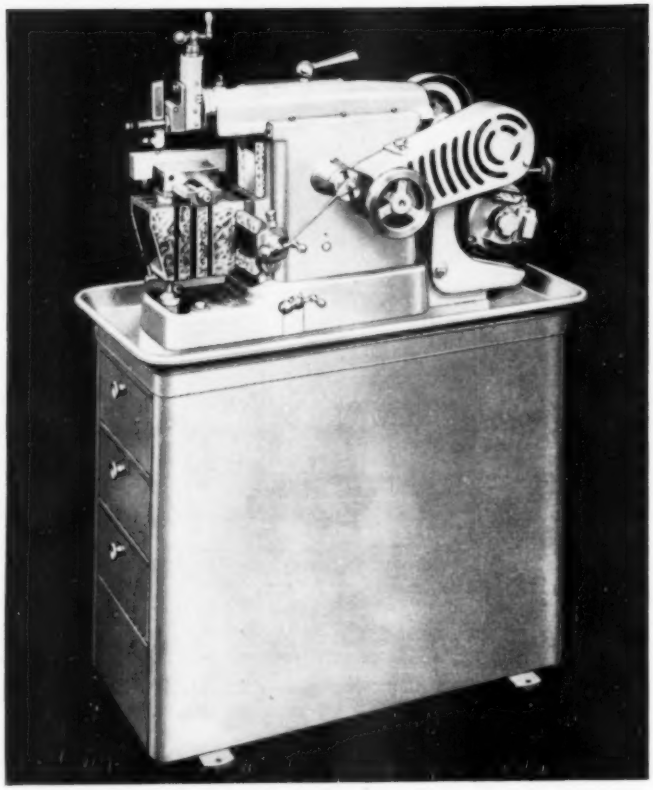
Danly High-Production Presses Have Capacities from 50 to 800 Tons

A line of medium- to high-tonnage mechanical presses are designed especially for stamping operations, employing standard progressive or multiple dies. Heavier plate structure through greater steel mass offers more accurate stampings and longer die life at higher operating speeds.

Press rigidity also maintains precision operation under severe off-center and progressive die loads. Presses are available in various sizes and types, having speeds to 250 stroke per min with capacities from 50 to 800 tons. Automatic feed of coil and strip stock is used to increase part output. To suit job requirements, presses can be obtained with the following drives: direct non-geared crank drive; single-reduction gear, eccentric drive; and double-reduction gear, eccentric drive.

Press frame components, including base, uprights and crown are made of heavy steel sections, welded and stress relieved. The bed is fabricated from steel plate. A floating friction-block clutch is employed, which makes it possible to transfer 85% of flywheel momentum to the driveshaft upon engagement. The Danly press clutch is a fan-cooled air-operated unit. The machine illustrated shows a 75-ton Danly high-production press producing continuous chain. Stock is fed from the reel on the left-hand side and finished chain is shown on the right. Clutch is mounted externally.

Danly Machine Specialties, Inc., Chicago, Ill.



Vise on the shaper swivels to any angle (with base graduated 0 to 90° right and left) and can be mounted on the top or right side of the table

South Bend Precision Bench Shaper Features a 7-in. Capacity

A 7-in. bench shaper is announced for toolroom and industrial use. This shaper is said to be capable of the most exacting work on parts within its capacity. Main castings for shaper are made of close-grained semi-steel. The ram and table slides are milled and hand-scraped for precision fit and are provided with adjustable gibs. Backlash is held to a minimum by fitting parts to close tolerances.

The ram is 18 in. long. Length of the ram stroke, 0 to 7 in., is adjustable by shifting the rocker-arm shoe until the witness mark corresponds with the desired figure on the rocker arm. A large handwheel aids in making the adjustment. Cutting speed is available from 3 to 114 fpm. Stroke rates of 42, 75, 120 and 195 per min are obtained by shifting a V-belt on two 4-step cone pulleys.

A quick-acting belt tension release of the tools facilitates belt changes. The toolhead has a 3-in. feed; it swivels to any angle and has a positive lock. A swivel clapper allows tool clearance adjustments to be made. The clear-cut graduated collar on the feed screw reads in 0.001 in. Toolpost provided takes tools with shanks $^{3}/_{8}$x$^{7}/_{8}$ in. Worktable is 5-7/16x5x6 in. deep, and is slotted on top and sides with holes for attaching the vise and special work clamps in various positions.

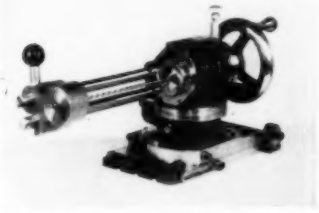
Reversible power cross-feeds for the table range from 0.002 to 0.016 in. per ram stroke. Graduated plate indicates the feed. Horizontal table travel is 9½ in., vertical travel is 5 in., and maximum distance from table to ram is 5½ in. Vise jaws are 4 in. wide, 1 in. deep and open to 4 in. A 1/3-hp 1725-rpm motor is required for power and is mounted on a cradle attached to the back of the shaper. Gib adjustment is provided on the table for take up.

South Bend Lathe Works, 378 E. Madison St., South Bend 22, Ind.

Aluminum-Soda Base Grease Offers Very High Melting Point

An aluminum-soda base grease offers an exceptionally high melting point. The heavier grease-type lubricant is designated STA-PUT 18H-2. Transparent green in color, the grease is recommended for industrial or automotive applications requiring a heavier grease than Houghton's original STA - PUT 18H; large heavily loaded presses, particularly older equipment where bearings are worn; heavy-duty applications in contracting, mining and dredging equipment; and hoists, cranes and similar heavy industrial applications, excepting electric motors or in ball or roller bearings where a soda-soap grease is recommended.

E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa.



D-S Grinding-Fixture Attachment For Radially Relieving Long Tools

An accessory for the D-S grinding fixture makes possible radial relief grinding of long tools not equipped with centers. Accessory mounts on the bars provided as a standard part of the fixture holds the tool close to the end for grinding support. A clamp is also provided to give extra rigidity to the unit.

The accessory swivels on the top bar permitting tools with large shanks to be inserted from the back and eliminating the need of moving the fixture from set position when the same form is being ground on more than one tool. Standard drill bushings and liners can be inserted for any size tool up to $1^{3}/_{8}$-in. dia.

Royal Oak Tool and Machine Co., 621 E. 4th St., Royal Oak, Mich.

WHY SPINDLE-SPECTION?

Sustained accuracy stems from the headstock spindle—the very heart of the lathe.

If it wasn't manufactured—and inspected—accurately, the lathe it goes into never will be a *precision* turning machine.

Monarch makes precision turning machines.

That's why we place such great stress on testing every Monarch spindle. The eleven elaborate tests we make are conducted in a separate department—we call it "Spindle-Spection".

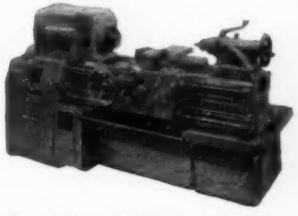
From your standpoint, it might well be called the "insurance department"—the place where one more clause is added to the invisible insurance policy that's built into every Monarch Lathe.

Other "clauses" include flame hardened bedways, induction hardened parts, helical gears in the headstock—and a host of others. Like to know more about these reasons why you'll get *peak production at a profit* with every Monarch Lathe? Ask for booklet 1112.

MONARCH'S
11 SPINDLE-SPECTION TEST TOLERANCES
FOR SERIES 60 LATHES

Spindle Nose Size	.0005"
Spindle Nose Runout	.0001"
Spindle Nose Bearing	100%
Spindle Runout (14" out from nose)	.0003"
*Bore Size	.0005"
Bore Taper	.000"
Draw	.0003" to .0005"
Bearings Runout	.0001"
Gear Bearing Seat Runout	.0003"
Bearing Size	.0002"
Bearing Seat Size	.0005"

*This test, illustrated above, is accomplished with Sheffield Precisionaire gauges, set to two master ring gauges.



ACCURACY · ECONOMY · LONG LIFE
Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO., Sidney, Ohio

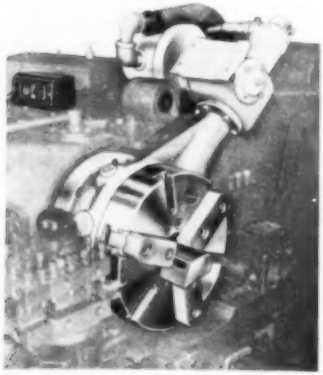
FOR A GOOD TURN *FASTER* —— TURN TO MONARCH

Hydraulic Dynamometer For Load-Testing Motors

Hydraulic dynamometers are offered for load-testing motors. Tests that can be made with the dynamometer include idle, pull-in, pull-up, full-load and locked. The locked test can be made without having to shut off the motor to insert a locking pin or similar device. All tests require little effort on the part of the operator.

The dynamometer is foot controlled. Exact foot-pounds of torque can be read directly from the gage furnished. Hydraulic dynamometer assembly No. SA-483 has a 30-ft lb capacity and adapters for ½-, ⅝-, ¾- ard 1-in. motor shafts. The dynamometer comes fully assembled on a steel bench top, approximately 36 in. sq.

Wagner Electric Corp., 5488 Plymouth Ave., St. Louis 14, Mo.



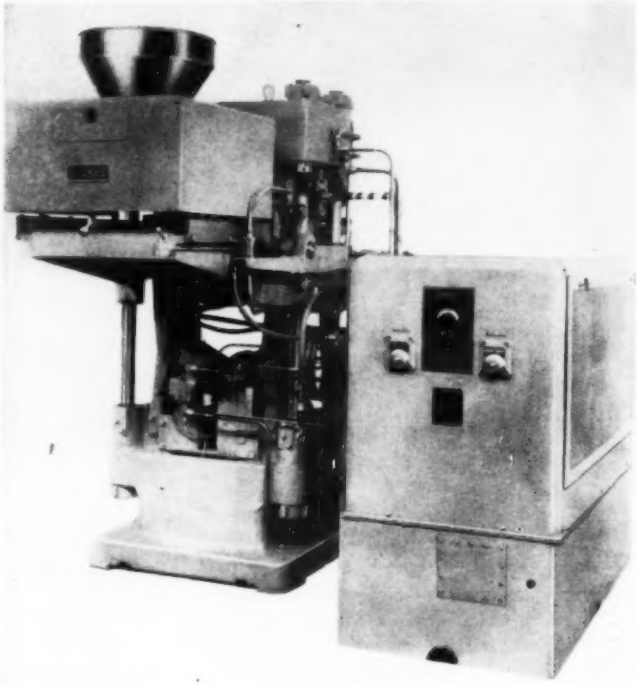
Air-O-Torque Chuck Features Center Hole, Rapid Jaw Action

The Air-O-Torque chuck features center hole and instant jaw action. The heavy-duty power chuck combines the features of both an air-operated chuck and power wrench-operated chuck. Chuck has a center hole, allowing feeding of stock through center of the chuck. The chuck has a housing which is attached directly to the lathe head.

The lathe spindle extends through the housing and is attached to the chuck. Thus housing remains stationary while the chuck is free to move with the spindle. Operation is similar to regular gear scroll chucks with an air motor driving the pinion which engages the scroll causing jaw to close or open.

Power for operation of the Air-O-Torque chuck is supplied by an air-operated motor providing ample pressure to insure positive grip at all times. Desired gripping capacity can be attained by a valve adjustment which controls the amount of air pressure used in operating the air motor.

The Whiton Machine Co., New London, Conn.



Stokes Automatic Closure Presses Produce Closures, Threaded Parts

The redesigned automatic 50- and 150-ton closure presses produce closures or threaded parts in large quantities at low cost. The self-contained compact presses require 15 sec plus curing time to automatically load, close, open, unscrew and eject closures. Production example is 5400 24-mm closures molded per hr on the 150-ton model; fewer cavities are required for a specified daily output.

A redesigned die transfer and rack cylinder assures trouble-free operation; electrical connections of the plug-in type simplify setup and maintenance of electrical circuits; and heat-resistant synthetic-rubber stripper bars eliminate the possibility of cap spoilage and assure positive removal of caps from the forces. Presses are designed to take a maximum mold or die area of 12x18½ or 19½x24 in. for the 150-ton model, and for either steam or electric heating.

F. J. Stokes Machine Co., 5900 Tabor Road, Philadelphia 20, Pa.

Thor presents the smallest GEM in the Silver Line*

smaller... lighter... more powerful than any other ¼" DRILL in the field!

Thor is now shipping from the assembly lines of its great new *Silver Line* this lightest, smallest, most powerful and highest quality 1/4" standard duty portable electric drill ever built!

It weighs only three pounds, is only 7-7/16 inches in length—yet in this small handful packs power unmatched by any tool in its class . . . plus all the features of Thor's amazing *Silver Line*—die cast housings, all ball bearing, Heli-Coil thread inserts, etc. Available in seven drilling speeds, from 550 to 5000 R.P.M. Write today for *Silver Line* Catalog E-2, or see your Thor distributor.

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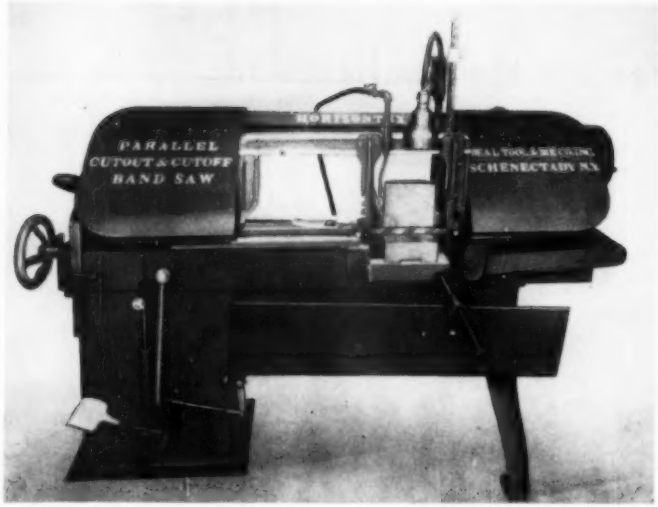
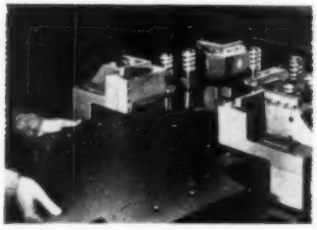


Cut-Out, Cut-Off Band Saw Has Parallel-to-Bed Cutting Action

A horizontal saw, the Horizontex No. 8 parallel cut-out and cut-off band saw, offers cutting action always parallel to the bed from start to finish. The parallel-to-bed descending action of the saw frame is controlled by a single supporting arm in front, and by double supporting arms in the rear of the machine, all arms being equal and interconnected by equal lengths.

A scale on the post is numbered from 0 to 8 in. for gaging depth of cut. Stop located on the post sets and measures depth of cut, tripping the switch for automatic motor shut-off when desired depth of cut is reached. Wheel on the hydraulic check valve adjusts descending speed of the saw frame. The vise jaws swivel 45°, and hold work within 1/16 in. of the blade. A four-speed V-belt drive is provided. The rectangular capacity of the Model No. 8 is 8x16 in.; Model No. 8A, 8x20 in. The speeds are: 55, 95, 160 and 265 fpm. Height of the bed is 26 in., width 9½ in. Over-all width and length are 28x26 in. Over-all height with saw raised is 56 in.

Ideal Tool and Die Co. Inc., 733-35 Congress St., Schenectady 3, N. Y.

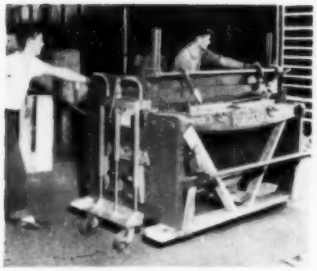


Heavy-Duty Notching Units Handle ¼-in. Mild Steel

A heavy-duty type NJ notching unit provides a maximum 5x5-in. 90° corner notch in metal up to ¼-in. mild steel. The Wales type NJ notching units have the same shut height as type CJ hole-punching units and therefore may be used in combination setups to punch and notch up to ¼-in. mild steel in the same operation.

All parts of the heavy-duty notching unit such as punching dies and punch-lifter springs are built into the self-contained holder. In this way the punches and dies are kept in permanent alignment. Complete setups, ready to operate may be made outside the press on T-slotted plates or templets. With these notching units the press ram has one function—to depress the punch. The punch is not attached to the press ram.

Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y.

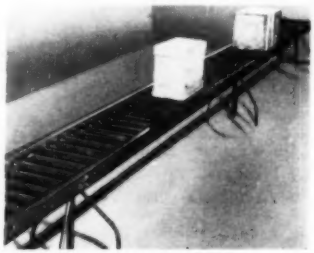


Skarnes Rol-A-Lift Handles Heavy and Bulky Loads

The Rol-A-Lift models are designed to handle crated or uncrated materials and products. It handles loads too heavy or bulky for fork trucks and will move loads into tight places where neither fork trucks nor cranes can operate.

The Model M-2 has a 2000-lb capacity and is especially suited for moving long counters, freezer units, storage bins and similar bulky items. The M-2 is built with adjustable forks to accommodate crates of varying width, and operates with a mechanical cam lift. The other model, M-8, has an 8000-lb capacity. It is suitable for moving heavy production machinery such as presses, cutters and lathes. Rol-A-Lift units are used in pairs and are moved about in the same manner as hand trucks.

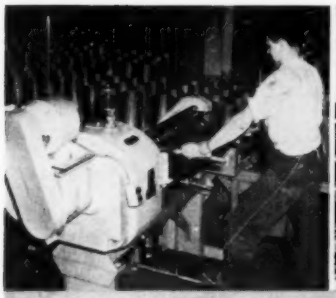
Skarnes Engineering and Supply Inc., 2528 Riverside Ave., Minneapolis 6, Minn.



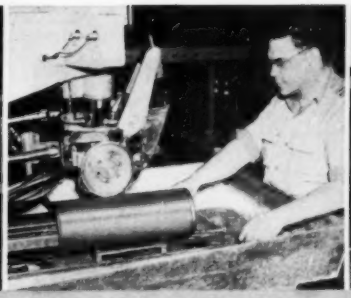
Gravity Roller Conveyors Made in 5-, 10-ft Lengths

Gravity roller conveyors are offered in 5- and 10-ft lengths and widths from 6 to 32 in. in increments of 2 in. Rollers are 2 in. in diameter, 16-gage steel with special ball bearings on both ends. Roller axles are made of 7/16-in. hexagon steel and are set in hexagon holes in frames so that shaft or cone does not turn on axle.

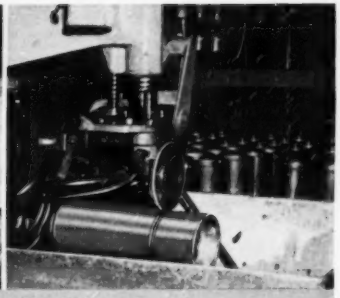
Sage Equipment Co., 30 Essex St., Buffalo 13, N. Y.



Rolling silicon bronze to the exact diameter before welding



Resistance welding of longitudinal seam



The bottom is resistance-welded to the shell

REVERE SILICON BRONZE IN RE-DESIGNED EXTINGUISHER

Everyone is familiar with the 2½ gallon fire extinguisher that is operated by turning bottom up. It is to be found in almost every factory, office and school. With it, countless fires have been put out, lives, property, jobs, money saved. Such a standard product tends to be taken for granted; most people naturally assume that it has reached its final perfection. Not so American-LaFrance-Foamite Corp., which some time ago decided to re-design its Alfco extinguishers in the light of the newest technological developments. To the user, the new extinguishers are definitely improved, being free from rivets, 4½ pounds lighter, and much more handsome. To the company, the product has been bettered in other ways, and is more efficiently produced.

Working out this extensive program required careful consideration of the relationships between design and materials, and materials, methods and machines. Alfco wished to abandon rivets and go to seam welding, among other things. Silicon bronze was selected as the material, because that can be easily resistance-welded, possesses strength of mild steel together with the corrosion resistance of copper. Revere and Alfco got together and jointly set up the time, temperature and pressure requirements for clean, sound welds. It was also necessary for Revere to establish the proper tempers for the body sheet so that it will more than withstand the Underwriters' pressure test, but still be formable into a cylinder with beads that locate the top and bottom domes. Similarly, tempers had to be selected for the sheet to be drawn into the domes. In all these and other activities the accumulated knowledge and experience of the Revere Technical Advisors, the welding section of the Research Department and of three Revere mills were used. Finally, the Research Laboratory tested the first production extinguishers to make sure that annealing practices were adequate.

The new Alfco Extinguisher, made by American-LaFrance-Foamite Corp., Elmira, N. Y.

Revere considers this an outstanding example of the benefits possible when a manufacturer and supplier collaborate on mutual problems. You are invited to consider Revere not only as a source of nonferrous metals, but of know-how in their selection and fabrication.

REVERE

COPPER AND BRASS INCORPORATED

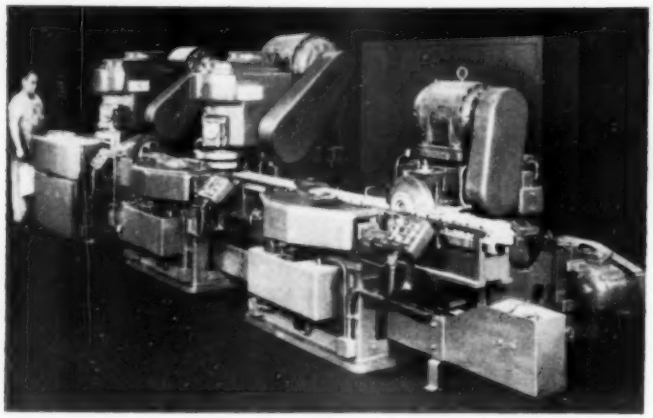
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

• • •

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in Principal Cities, Distributors Everywhere.

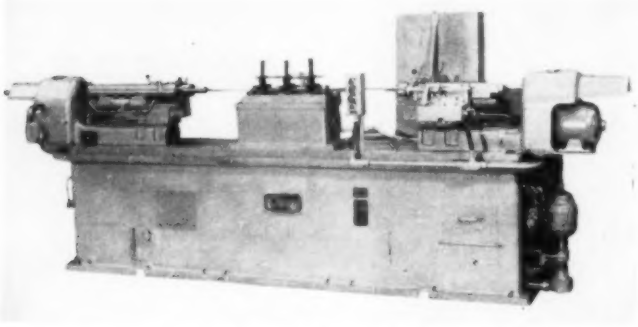


Automatic Transfer Machine Mills Top, Bottom, Sides of Cylinder Head

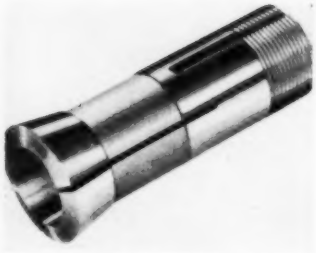
An automatic transfer Rigidmil mills the top, bottom, and both sides of cylinder heads. The machine consists of three milling stations, one turn-over station, an idler station, and loading and unloading stations. All stations can be controlled from the master-control-button panel or individually from the station-button control panels.

The cylinder heads are shuttled from station to station by the return movement of the milling heads making it unnecessary to have a separate shuttling device. A motor-driven chip conveyor removes the chips from the machine. The operator locates the cylinder heads on a loading station and presses the cycle start button. All movements following are automatic. Each milling head has an automatic cycle of rapid approach, speed, and rapid return. All of the traveling heads are intertimed so that none will start the rapid return or shuttling movement until all are ready, thus making a pile-up of workpieces impossible.

Sundstrand Machine Tool Co., Rockford, Ill.



SPECIAL DRILLING MACHINE was built and designed to drill a deep hole 0.219 in. in diameter through a transmission shaft 18 in. long with a maximum run-out of approximately 0.012. The machine consists of two No. 2 Avey-draulic deep-hole drilling units mounted horizontally and opposed on a steel-fabricated base with both units automatically drilling parts from each end simultaneously. The Torquematic drive provides for automatic withdrawal of drill only when necessary during deep-hole drilling. Production is approximately 12 to 15 transmission shafts per hr. — The Avey Drilling Machine Company, Cincinnati 1, Ohio

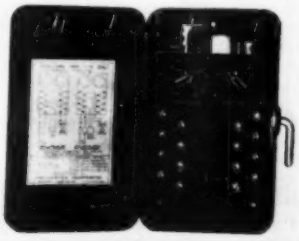


Wade Collets Feature Threads Ground from Solid After Hardening

Wade Collets are now offered with threads ground from the solid after hardening, providing against possible distortion in thread pitch or in thread shape. There is no distortion as to concentricity, as threads are concentric with the rest of the collet. Collets feature the buttress thread instead of the customary 60° standard thread.

By presenting mating surfaces at right angles to the pulling force, any expanding tendency is eliminated, assuring maximum strength and security. There can be no overriding of screw threads. The Wade collet seal is also available. It entirely closes the slots giving protection from chips.

Wade Tool Co., Waltham, Mass.



Electronic Timer Handles Intervals from 1/20 sec to 4 min

An electronic timer, Type 30HL1, is an automatic timer for intervals from 1/20 sec to 4 min. It is recommended for process control and machine timing when long-life repeat-cycle operation or precise accuracy is a prerequisite. The timer provides four basic types of timing: interval, delayed action, automatic repeat and programming, as well as many variations of these four fundamental types. All of the timing combinations are incorporated in this one timer and may be utilized by merely changing external connections.

Photoswitch Inc., 77 Broadway, Cambridge 42, Mass.

Cut Broach Sharpening Time 25% with

"STEP-STOP" MICRO-FEED

ON THE NEW Colonial UNIVERSAL BROACH SHARPENER

In sharpening a round broach on this Universal sharpener, the wheel is brought to depth on the first tooth. The "Step-Stop" slide is locked. The operator shifts to the next tooth and brings the wheel to full depth—to a definite stop. To his right is a micro-feed wheel with which he increases depth an amount equal to the step of the tooth. When the next tooth is ground the "Step-Stop" lets the wheel come in to this increased depth before hand-feeding with the micro-feed is required.

Where the step-per-tooth is small, the operator frequently can grind 3 or 4 teeth without using any hand feed—he just brings the wheel up against the stop each time.

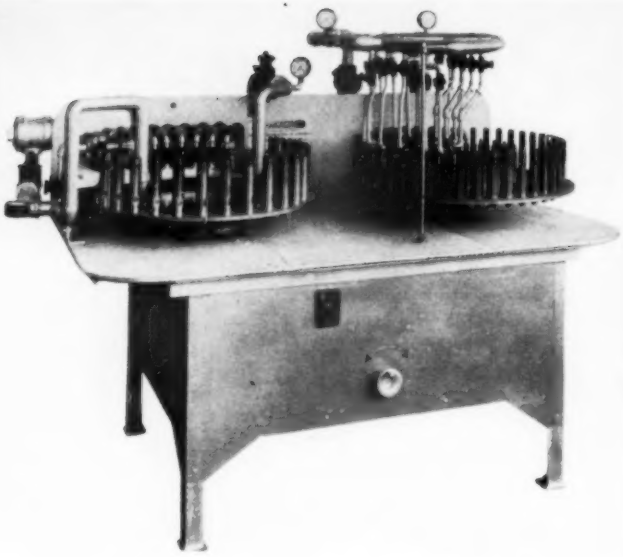
Ask for Bulletin No. S-48-2

This is just one of the features of the new Colonial Universal Broach Sharpener shown here. Others include: New center-point steady rests for quicker setup; Low-inertia head; Dual head-slide handles to make both round and flat broach grinding as easy as possible for the operator . . . and all the other features which make Colonial's 1949 sharpeners "tops" for accuracy and speed.

PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13



Controlled Radiant Gas Heat Offered In Silver-Alloy Brazing of Brass

A special-purpose automatic machine employs closely controlled radiant gas heat in silver-alloy brazing of brass sub-assemblies. The machine brazes eleven joints on 540 units per hr by the Selas Gradiation method. Seven joints brazed simultaneously, are gas-tight; four support joints are also brazed simultaneously.

The machine has 46 ceramic gas-air burners, each of which is adjustable with additional heat control provided at the four burner mainfolds. The two turntables are controlled by a variable-speed drive, synchronized exactly to the requirements of heating time and gas volume.

Pre-mixed gas and air are supplied to the machine in proper proportions for complete combustion at constant pressure. The fuel requirements of the machine are estimated at 350 cu ft of 1000-Btu natural gas per hr.

Selas Corp. of America, Erie Ave. and D St., Philadelphia 34, Pa.

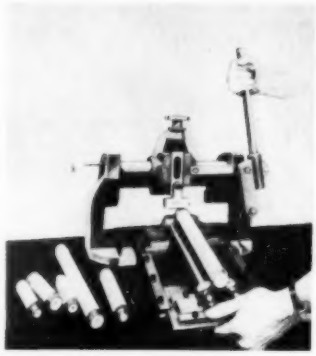
Truarc Self-Locking Retainer Requires No Groove, Special Tools

A self-locking device is designated the Truarc Triangular retainer, Type 5305. It is useful in developing tight assemblies free from end-play on relatively soft shafts such as cold-rolled steel, castings and plastic materials. The Truarc Triangular ring has been specially designed as a low-cost retainer, requiring no groove or special tools for assembly and disassembly.

The retainer is made with a flat or spherical cross-section, and has three equally spaced projecting prongs. When slipped over a shaft, it can be positioned in the direction of installation. At the same time the three prongs tend to lock securely around the shaft when even the slightest pressure is applied from the opposite direction.

The retainers resist considerable thrust loads, vibrations and impacts, and are available in sizes for shaft diameters ranging from 0.090 to 0.375 in.

Waldes Kohinoor, Inc., Long Island City 1, N.Y.



Extension Cradle Rolls For Marking Cylindrical Parts

Extension cradle rolls offer a telescoping principle permitting quick adjustment for varied lengths of cylindrical parts. Fuses, tubes, bushings, rods, shafts, mandrels, and other parts can be marked in the Model 9A marking machine.

The fixture is made of two sets of cradle rolls, both adjustable for diameter and both mounted on a main plate. One set of rolls is permanently mounted, adjustable only for diameter of part to be marked. The other set is mounted on a slide plate. As the adjustable set of cradle rolls is pulled out, the shafts pull out also, stopping when the limit of shaft length has been reached.

The Acromark Company, 7-13 Morrell Street, Elizabeth 4, N.J.

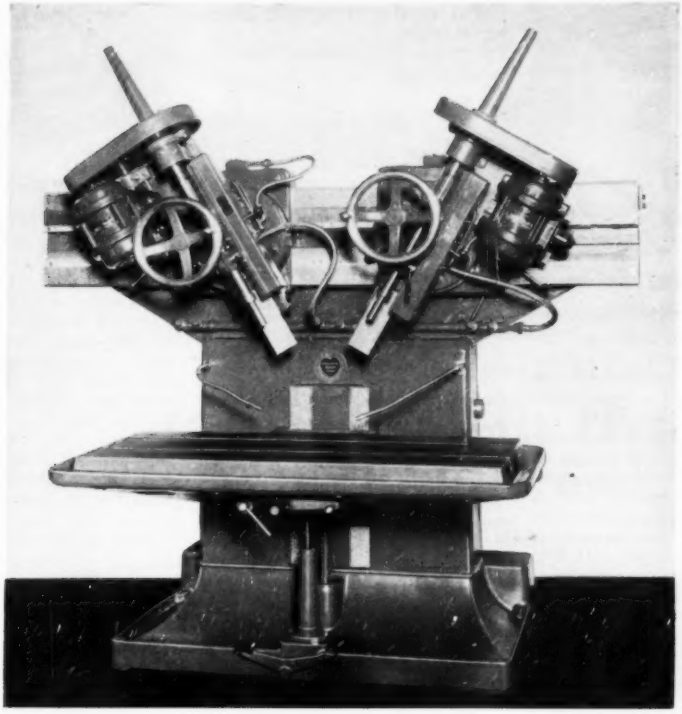
The V13 Series Control Valve Handles Oil-Hydraulic Cylinders

The V13 series control valves will handle several oil hydraulic cylinders simultaneously. It can be furnished with control plunges for actuating two, three or four single-acting or double-acting cylinders at operating pressures up to 1400 psi. It is designed for industrial oil-hydraulic systems to actuate more than one hydraulic cylinder at the same time, providing pressure to the cylinders are equal.

With cylinder outlets tapped for 1_2 in. IP connections, the model V13 valve can handle 14 gpm at full pressure. Valves are built around the patented Hydreco hollow-plunger design which eliminates momentary load drops and dead spots in valve operation. Valves are available for direct or indirect manual control and for varied mountings and connections.

Hydraulic Equipment Co., 1100 E. 222nd St., Cleveland 17, Ohio.

A UNIVERSAL RAIL TYPE DRILLING MACHINE



- Spindles have angular adjustment through 90 degrees.
- Center distances from 15½" to 62" when vertical.
- Hydraulic feed with either plain or step by step control for deep hole drilling.
- Heads are easily and quickly moved along rail by means of handwheel and rack and pinion.
- Angular adjustment of spindles is conveniently and quickly made by means of worm and worm wheel and graduated ring.
- Nema Motor drive.

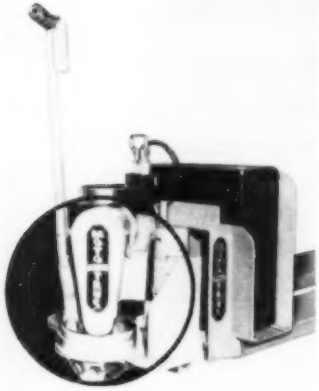
LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.

Layout and Inspection Plate Has Adjustable Illuminated Magnifier

A precision-ground layout and inspection plate features an adjustable illuminated magnifier. The plate is 11x9 in. and is cross ribbed on the underside for rigidity. The illuminated magnifier is adjustable to any angle and to any height up to 10 in. The magnifier has a 4½-in. dia, specially ground lens. A 25-watt tubular lamp is provided on each side of the magnifying glass. Lamp is equipped with 6 ft. of rubber-covered cord and standard plug for 110-v current.

All American Tool & Mfg. Co., 1014 W. Fullerton Ave., Chicago 14, Ill.



Motor Unit Offered For Hand-Truck Equipment

A motor for motorized hand-truck equipment permits accessibility to all operating parts. Features of the ball-bearing motor are larger armature and field coils, high starting torque and lower draw on battery. The interchangeable-motor feature of the Rand truck has made it possible to replace motors in 15 to 30 min, minimizing delays in servicing, and to apply it to many of the older types of motor trucks. Pushbuttons in the ends of the handle (within fingertip reach) control lifting and lowering of truck.

Moto-Truc Co., Cleveland, Ohio.

Fork-Truck Roll-Over Attachment Provides 180° Rotation of Forks

The Roto-Lift assembly is offered for the company's 2- and 3-ton Yak and Yank fork trucks. The assembly provides 180° rotation of forks in either right-hand or left-hand direction and is powered from the hydraulic pressure system of the fork truck through flexible pressure lines and electric limit switches.

Rotation of the fork carriage is accomplished by a double-acting hydraulic cylinder and ram assembly with spur-gear drive to the ball-bearing-mounted turntable on which the carriage revolves.

Mercury Manufacturing Co., 4111 S. Halsted St., Chicago 9, Ill.

Fire-Retardant Paint, Coating Resists 2000 F Flame for 30 Min

A fire-retardant and non-toxic paint resists 2000 F flame for 30 min. Called Flame-Seal, the paint requires no mixing of special ingredients and can be applied directly from its original container by brush or spray gun.

The fire-retardant paint is also said to be moisture-proof and termite proof, and will not craze, chip, peel or crack. It can be washed with any standard soap or washing powder without lessening its fire-retardant effectiveness. Flame-Seal is available in an oyster-white flat finish and can be obtained in single quarts, 2- and 5-gal. cans and 55-gal. drums.

Stallton Chemical Corp., 8-14 37th Ave., Long Island City 1, N. Y.

Ball-Tilting Milling Table Tilts 30° Any Angle

A ball-tilting milling table is made from fine-grade Meehanite semi-steel normalized castings. All parts are of rigid construction and precision machined. Ball will tilt 30° any angle. Ball-angle adjustment is performed by loosening one of the three locking bolts. Rotary base calibration is engraved for the 360° and locked securely with two T-slot bolts in any position without distortion. Each cross feed has an Acme thread screw with bronze nut and has a 6-in. travel slide feed. Cross-feed slide bronze gib has 3 adjustment screws for take-up of slack. The T-slot is ¼x⅞ in. for the ½-in. bolt.

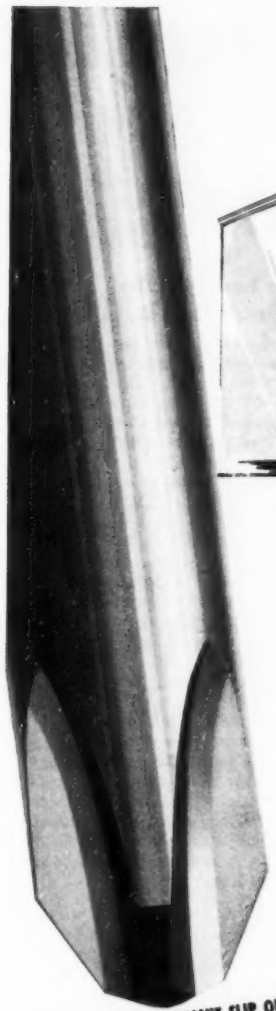
Leo G. Brown Engineering Co., 1531 S. Sunol Drive, Los Angeles 23, Calif.

Rugged Switch Combines High Electric Rating, Inrush Capacity

The BAF1-2RN switch, designed for severe service in industrial use, is a rugged, inclosed switch that combines high electrical rating with high inrush capacity.

The switching element is the high-capacity Type A basic switch having a steady state current rating of 20 amp and inrush capacity of 75 amp, at voltages up to 460 ac. A sturdy overtravel mechanism is built into the housing to insure long life and accurate repeatability of operating point. For surface mounting, three holes are provided for ¼-in. screws through 17/32 in. of metal.

Micro Switch Div., Freeport, Ill.



4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

FOR A SHARPER IMAGE OF

TOP PROFITS IN TELEVISION PRODUCTION and SALES

... set-builders use

AMERICAN PHILLIPS SCREWS

SEE NEW PRODUCTION PROFITS: Assembly of costly television sets puts a prohibition on spoilage. That's why American Phillips Screws are used, to help keep sets rolling out to an eager market, and to keep rejections down. No delays or losses, then, and output hits the main channel with highest return per man-hour, *which means time-savings up to 50%!*

SEE NEW SALES-STIMULATION: Smoothly finished, unmarred cabinet work is the basis of television-set sales. And that's the way sets come from an assembly department using *American Phillips Screws.*

Does YOUR product have this double-feature of production-economy and sales promotion? Then write:

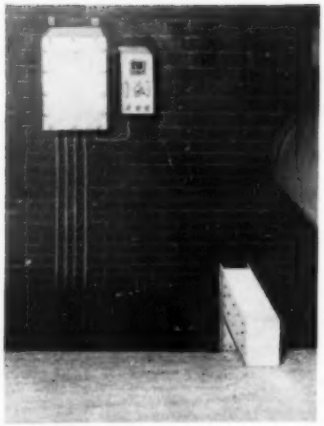
AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois St. *Detroit 2:* 502 Stephenson Building

AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)



GE Thickness Gage Measures Without Contacting Material

The Beta-Ray thickness gage is offered to measure continuously the thickness of sheet materials moving along a conveyor without contacting or disturbing the material. The instrument measures the amount of beta-rays which are absorbed by the sheet material being checked.

By measuring absorption, the device actually indicates the mass per unit area of the material under test, but the equipment can be calibrated in terms of thickness to help operators maintain product uniformity, reduce the amount of rejected material and save on the amount of raw material used.

Operating on a power supply of 100-125 volts, 60 cycles, ±0.3 cycles, power consumption of the gage is about 150 watts. Accuracy is ± 2% or better between normal periods of calibration, while drift is not more than 1% per hr after a 30 min warm-up.

The gage will find application monitoring the thickness of metal foils, such as aluminum, copper, tin, brass, and steel being rolled at high speeds. It can also be used with plastics, textiles, rubber and other sheet materials.

General Electric Co., Schenectady 5, N. Y.

Jones & Laughlin New Steel Permits Increased Production

A steel which can be machined ten to 25% faster than the fastest standard free-machining Bessemer screw steel, the J&L "E" steel can now be furnished in cold-finished bars. The machinability index is 170. The steel has a smooth finish after machining, good cold working and cold forming properties, and gives longer tool life on screw machines. It is said to permit increased production and lower costs in the manufacture of nuts, screws, studs, fittings and other types of machine products.

Jones & Laughlin Steel Corp., Pittsburgh 30, Pa.

Drop-Forged Safety Hoist Hooks Offered in 5- and 10-ton Sizes

The BTC drop-forged safety hoist hooks offer automatic mousing action. This action with a safety-tie lip lock holds the point of the hook and prevents the sling from slipping off; tie also adds to the strength of the hook.

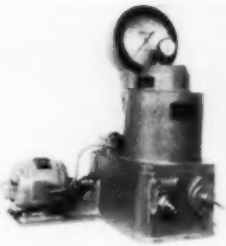
The safety-tie mousing automatically engages as the load is applied and disengages as the load is released. The shoulder and lip-lock construction gives a wide margin of safety; the pin can be sheared without affecting the load-holding capacity of the hook. Illustrated, left, is a 5-ton BTC safety hook with eye bridge; center, 10-ton safety hook with eye bridge; and right, 10-ton safety hook with shank bridge.

The Brewer-Titchener Corp., Cortland, N. Y.

Welding Kit Contains Low-Temperature Alloys, Fluxes

A handy compact welding kit contains low-temperature alloys and fluxes for any gas-welding job. The kit comes in a metal box and is known as the All-State DOC Alloys Kit. Box size is 2x4½x20½ in. and includes an ample supply of silver solder and ten different kinds of low-temperature gas welding rods, a low-temperature galvanizing powder and eight fluxes. The rods are individually color marked and are in labeled pockets in a leatherette roll. The cover of the box contains a convenient chart of the contents with practical working directions.

All-State Welding Alloys Co., Inc., 275 Ferris Ave., White Plains, N. Y.



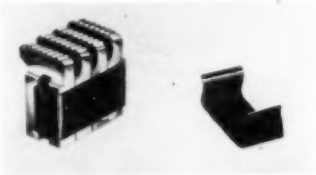
Ductility Testing Machine Available in a Bench Model

A bench-model ductility testing machine tests the drawing qualities of sheet metal. The compact machine is 2 ft 11 in. in height and 26 in. across. Speed of the piston travel is adjustable within a wide range by means of a dial setting. Tests can be made in as little as 15 sec.

The machine is built with a capacity of 15,000 lb to cup test material up to ⅛ in. in thickness, or 30,000 lb for material up to ¼ in. in thickness. The model is motorized and hydraulically operated, and incorporates two concentric pistons.

The outer piston grips the workpiece against the head at the top of the machine, while the inner piston makes the cup in the specimen. An 8½-in.-dia pressure gage incorporates a maximum indicating hand to show pressure at which yield in the specimen occurs. Depth indicator shows depth of draw at any moment by means of direct reading.

Steel City Testing Machines Inc., 8845 Livernois Ave., Detroit 4, Mich.



Geometric Chaser Clip Keeps Chasers in Order

The Geometric Chaser Clip is designed to keep Supermetric chasers in order. It is a spring steel clip offered to take the place of the former method of wiring, giving a permanent and convenient way of holding the chasers together in a set before-and-after using. It simplifies handling and saves chaser teeth from damage.

The Geometric Tool Co., Blake and Valley Streets, New Haven 15, Conn.

Want MORE TURNOUT in the BIG-Hole Range?

The "Buffalo" No. 22 is the Drill For You!

- Convenient adjustments slash setup time. 8 quick speed changes! Handy table-raising screw! No wrenches required!
- All controls within ready reach—easy handling! Quick shift from direct to back gear!
- 2" capacity in cast iron—a big, accurate rigid machine 97" high with 1.312" spindle and 515" steel column
- Single or multispindle models! Sensitive or power feed!

WANT ALL THE FACTS? WRITE FOR BULLETIN 2989-F! Gives complete data on this big drill that handles as easily as a small drill—for economy on the big holes!

"Buffalo" MACHINE

BUFFALO FORGE COMPANY

509 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

DRILLING PUNCHING SHEARING CUTTING BENDING

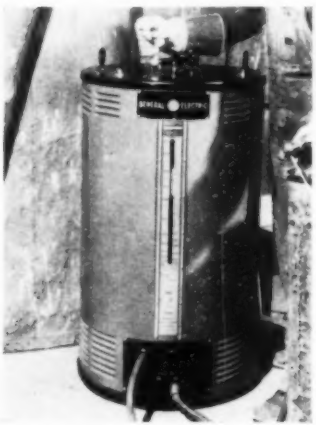
Nu-Matic Power-Wheel Grinder Sands, Polishes, Grinds

A pneumatic rubber drum inflated at low pressures is the basis for the improved Nu-Matic grinder. The low-cost power-wheel unit is used for grinding, sanding or polishing curved, irregular and contour surfaces.

The grinder is portable and can be used on a bench or flexible-shaft motor. Standard abrasive bands, 5 in. in diameter and 3½ in. wide in a variety of abrasive grits (24-500 grit) can be changed from roughing to finishing in a matter of seconds.

Changes on replacements are accomplished by releasing the air and then reinflating to working requirements. The grinder is provided with one adapter to fit ⅝ in.-11 or ½ in.-13 thread power shaft.

Nu-Matic Grinders, Inc., 10304 W. McNichols Road, Detroit 21, Mich.



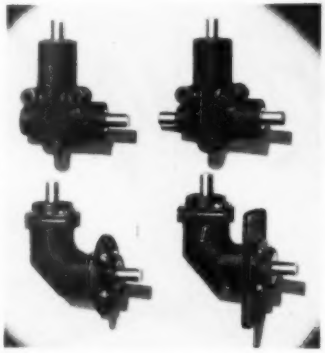
GE Line of Ac Arc Welders Offers Stepless Current Control

A line of ac arc welders features increased welding range and stepless precision current control. The welders are available in 200-, 300-, 400- and 500-amp models for indoor manual welding; 750- and 1000-amp models for machine and submerged-melt welding, and a special 200-amp model for light-duty job-shop welding.

The 300-, 400-, and 500-amp models are also offered in weather-resistant inclosures with Idlematic control for both indoor and outdoor operation. Dual-current ranges, and increased-adjustment overtravel on the new machines provide extra low current range with high maximum short-time output.

Welders are designed with stepless current control, operated by a bearing-mounted current-adjustment crank which enables the operator to make precision settings throughout the current range. The welders have an open-circuit voltage of 75 volts.

The General Electric Co., Schenectady 5, N.Y.



Right-Angle Bevel-Gear Drives for Manual-, Power-Operated Systems

Anglgear units are standardized right-angle bevel-gear drives suitable for use in either manual or power-operated systems. They are designed for the exacting requirements of military and commercial aircraft, but are applicable to many industrial applications requiring capacity, precision, and durability beyond limitations of commercial products.

Anglgear units are available in standard 1 to 1 ratio, in two sizes in four models. The two heavy-duty models are: R-160, the circular flange-mounted right-angle type; and R-190, the rectangular flange-mounted, right-angle type. The medium-duty models are: R-200, the three-hole mounted right-angle type; and R-210, the three-hole mounted T- type.

All materials, tolerances and lubrications are suitable for operation in the range of —65 F. to +160 F. The heavy-duty models mentioned are rated at 500-in. lb ultimate static load. The medium-duty models are rated at 250-in. lb ultimate static load. Each is production tested to this rating. Operating-load ratings for power transmission are dependent upon torsional-load shaft speed, duration of frequency of operating period, maximum ambient temperature, and expected service life.

Airborne Accessories Corp., 25 Montgomery St., Hillside 5, N.J.

Bruning Whiteprinter Has Output of 105 Sq Ft per Min

A large-volume Whiteprinter has an output of 105 sq ft per min. This machine reproduces anything drawn, typed, written, or printed upon translucent mediums. Prints from post-card size up to those 42 in. wide and any length can be made on the same machine.

The Volumatic Model 93 produces positive prints (black lines on white or tinted stocks) directly from the original drawing or document without intermediate steps. The BW process is oderless. Machine can be operated anywhere in the plant or office without ventilating ducts.

A sheet-separating device automatically returns the original to the operator, while sending the print on through the developing unit of the machine. The operator chooses between front and rear stacking of finished BW prints by moving a lever.

Another feature provides uniform development of prints regardless of speed setting. The exposed print is fed automatically between developer rolls applying the developer solution to both sides of the paper simultaneously.

Speed of development is automatically coordinated with printing speed of the machine.

Charles Bruning Co., 4754 W. Montrose Ave., Chicago 41, Ill.

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PARKER-KALON SIZE-MARKED socket head cap screws

Tool crib bosses

like 'em because sizes are issued correctly and the size-mark speeds up sorting of left-over, mixed-up screws . . . eliminates waste.

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like 'em because the correct size and thread pitch, clearly marked on the screw head, helps them learn faster . . . work faster.

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like 'em because they can spot the right size at a glance. No need to waste time guessing or gauging.

Yes, and Sales managers

like 'em — they recognize the sales advantages of the size-mark to customers' service men in the field on reassembly jobs.

with GEAR-GRIP -fingers won't slip*

Parker-Kalon Gear Grip prevents fingers from slipping even when oily. Makes fast fingers *sure* fingers.

ONLY ON PARKER-KALON Socket Screws will you find the Size-Mark and Gear Grip . . . developed after extensive study of shop practice to speed work. Samples Free, on request. See why P-K "years ahead" Socket Screws can put your product out front, assembly-wise as well as sales-wise. Send for Stock List Now. Parker-Kalon Corporation, 200 Varick Street, New York 14, N. Y.

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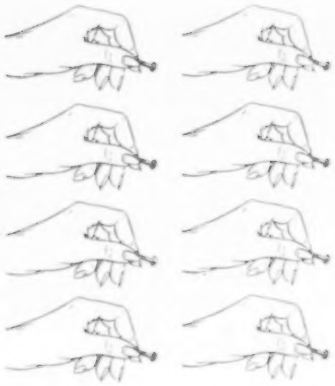
*U.S. DESIGN PAT. NO. 126,409



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. . . the sure, rapid, and economical answer for the manufacturer who must include a specific number of screws with his packaged product. Holtite Taped Screws eliminate the tedious and costly process of counting screws by hand. They save the expense of envelopes or bags. They allow the packer to put the exact number in the package — in a single operation — without a chance for error! For free sample and estimates, write to

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SCREW COMPANY
NEW BEDFORD, MASS., U.S.A.

1904

1949

ROUND TABLE Discussion

CLIQUE OR CLICK

There is much to be considered in the case under discussion and Ed seems to be doing this. He probably contemplates the influence of the older brother and the possible favoritism which may occur; the influence of those in his home such as mother, sisters or others, and these have their bearings. In any small community, a boy's opportunities in a shop are discussed between mothers and other women neighbors over the backyard fences where opinions are sought and ideas are exchanged. This is because so many women have the hoof and mouth disease and there is no known remedy with which to overcome it.

The young man may be ambitious, conscientious and may be wanting to learn the trade. He may become an asset or a liability to the company just the same as any other boy who has no brother located there.

Ed would make a good move if he would become well acquainted with the prospective candidate before he comes to work, especially as this is his first experience of the kind. He does not want to make any move such that the firm will lose dough.

A case in point comes to mind. A corporation, the leader in its line, located near New York, prides itself that in several cases they have numerous pairs of brothers working there, and, in at least one case, they have the third, fourth and fifth generations of the same family working together, a double father and son combination that has worked well.

Naturally, the father and grandfather are interested in teaching the boy the very best which they know, and, from there on, they expect him to study and learn more of the up-to-date developments as they may appear to him from time to time.

Another firm, near Buffalo, has tried the two brother idea and has found that in more than half the cases there is no real harm in it and many of the boys have become marked successes.

These firms figure that some very good and able young men enter the shop and immediately become interested in their work, help to maintain the rate of production and keep up morale; also many, many times they develop new ideas which are of benefit to all concerned.

There has been at least one case

CROSS UNIVERSAL GEAR MACHINES

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- ROUNDING
- CHAMFERING
- POINTING
- BURRING

Cross Universal Gear Machines embody advanced engineering developments to obtain highest productivity and assure lowest possible operating costs.

They feature utmost flexibility for handling a wide variety of gears. Continuous cutting motion, exclusive with Cross, speeds production at top efficiency.

Special skill is not required because machines are automatic and push button controlled. Power clamping is foot pedal controlled. Both hands are free for work handling.

No. 55

For rounding, pointing, chamfering or burring external and internal:

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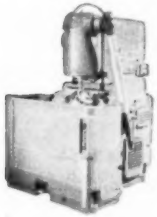
helical gears
clutches
splines

Typical productivity when rounding or pointing 8 pitch 30 tooth gears is 55 net hourly.



No. 65

For pointing or chamfering external and internal:

clutches
spur gears
bevel gears
splines

Typical productivity when pointing 10 pitch 30 tooth gears is 100 net hourly.

No. 75

For burring or chamfering both ends at the same time.

helical gears
spiral bevel pinions
hypoid pinions

Typical productivity when chamfering 8 pitch 40 tooth gears is 200 net hourly.

THE CROSS COMPANY
Established 1890
SPECIAL MACHINE TOOLS
MILLING • DRILLING • TAPPING • BORING
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DETROIT 7, MICHIGAN

where a man managed to obtain a place for his younger brother in the same shop where he was employed, but the two became too chummy, and the amount of their production went down so both of them graduated from there.

In my debut in the machine shop . . . my foreman was even tempered, that is, mad all the time, and in disposition he was as hard as a door knob towards every man who worked under his direction, but he was square to the limit, kept up the morale of his department and was either feared or liked by all of us. He always stood behind his men at all times.

Two of his sons worked in the same department and, due to the schooling he gave them, they were very good mechanics but there was no favoritism as is shown by the following incident: One day the younger of the two sons "sassed" the old man and found himself lying on the shop floor. That ended anything in the way of work by the boy for the rest of the day. He put on his dry goods and went home. The next day he returned, but he knew that he had to work hard and he did just that. The old man was no easy mark for his sons any more than he was for any other man.

To sum up, there is no more risk in taking into a shop the brother of a man already employed there, than there is in accepting any youngster who has the stamina to stick long enough to really learn the trade.

F. H. Stebbins
Worcester, N. Y.

•

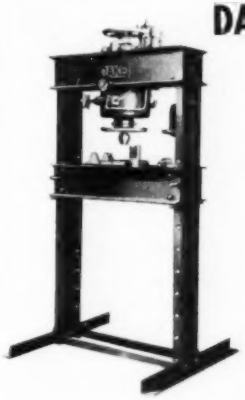
Is it dangerous to have relatives working together in the same shop? From my observations of this in three states and the Province of Ontario, it has appeared to be that there is more danger of relatives forming into a clique and becoming an annoyance in the smaller shops. The old saying, "blood is thicker than water" seems to prove up here.

I have seen several examples where just two of them gathered a couple of followers. Two plus two made four birds of a feather and we had a clique that was a menace. They began to gather and hoard certain tools and equipment among themselves. You just had to stand in with them or you were out. They made it exceedingly hard on any new man starting in that shop. By the time one particular shop got wise they had to fire five to bust the clique.

Two father-and-son combinations

DAKE AIR HYDRAULIC PRESSES

Speed Production
Lower Costs



The 50PB Air Hydraulic Press illustrated is a 50-ton capacity press of compact design with all operating controls within easy reach of operator. This accelerates the work and banishes operator fatigue. A speedy press to lower costs on assembly and disassembly; broaching, trimming, straightening, and bending; blanking, drawing, and forming; riveting and many other jobs in machine shop or on assembly lines.

The 50PB is one of several in this class ranging from 25-tons capacity to 125 tons.

No hand pumping . . . finger-tip control.

Pressure Gauge . . . at eye level.

Release Valve . . . returns ram to starting position.

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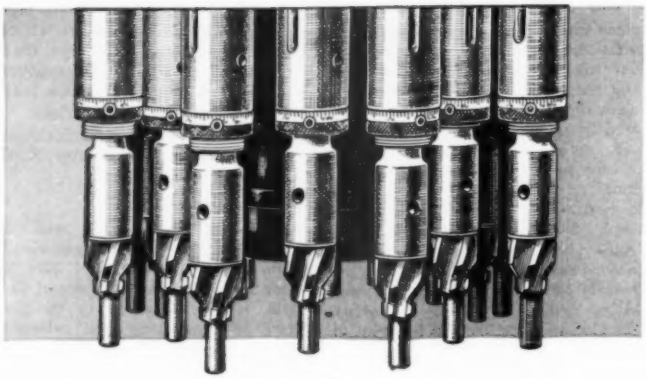


NOW . . . a *New* Gairing MICRO-NUT

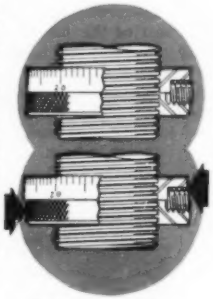
THE "FUL-GRIP" IS ACCURATE, COMPACT, ECONOMICAL

GAIRING who, years ago, was first to make a micrometer adjusting nut under the name of Micro-Nut, offers a completely new, much improved version: the GAIRING FUL-GRIP MICRO-NUT, much lower priced.

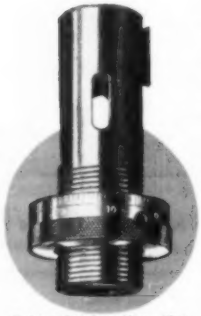
Fitting all standard adapters, with or without keyways, it provides a *full grip* between the thread angles of nut and adapter or other threaded tool shank.

Made in two pieces permanently assembled, this nut may be freely moved up and down along the threads to its approximate position. (No spanner wrench is required to move nut on threads). A mark is then made on the spindle opposite the .001" graduation provided on the nut. From that point on adjustment may be made to well within .001". When set, the Allen screw in the nut is tightened.

This set screw does not come in contact with the thread on the adapter, where it might cause damage. It merely alters the relation between top and bottom halves of the nut, and causes a tight grip on the angle of the threads all around, giving perfect parallel contact between top of nut and end of machine spindle.



Tightening of Allen screw moves top and bottom parts of nut in opposite directions, giving full grip on threads all around



Gairing Ful-Grip Micro-Nut on a standard adapter

On drill heads and multiple spindle set-ups, Micro-Nuts are everywhere replacing the standard adjusting nut. They accurately set tools to correct depths and permit quick and accurate individual adjustment, after replacement or regrinding.

Gairing Ful-Grip Micro-Nuts are a well engineered answer to this widely felt need. They will retain their true diameters, as the rings are solid and threads uninterrupted. Made in standard sizes ¾" to 1⅞" with National Acme Thread. V-thread is made to order only. Write for literature.

GAIRING TOOLS

THE GAIRING TOOL COMPANY, P. O. Box 478, Detroit 32, Michigan

showed up bad among my observations—one in particular was where the father was foreman. The son not only acted as a listening post for Dad but he took it as a means to tattle on men he took a dislike to. The son happened to stretch the truth on the wrong man one day.

The man took the matter to the proprietor who investigated and the result was that father and son were fired. Now I confess to employing a distant relative myself some years ago in a small tool and die shop. In time he came to me with a "did I know So and So was doing something when I was not around?" I informed him I was there to run the shop. That what I did not see was not worrying me and was of no concern to him. The man in this case was my best diemaker. In the time his machine was running a cut, he was building a tool for himself that was for company work. This little bit of homework as we term it is permitted by many places.

In the big shops with more men, the relative question seems to tone down quite a bit. My conclusion is that they form such a small majority in a large group that they don't get the same chance to form a controlling clique to gang up to any great extent. So we find them getting on much better in the big shops such as Studebaker's.

Not to be taken as out and out against the relative question in a small shop, let me say this: An exception to this clique of relatives could exist. In that case the circumstance could govern the decision to be made. However, my conclusion is watch out and proceed with relatives with the caution sign always in mind.

Henry Rasmussen
Niagara Falls, N. Y.

•

The hiring of family groups has long been a debatable question with personnel managers, factory managers and foremen. Many organizations have rules today which state that only one member of a family is eligible to work in the same department with another member of the same family.

This does not mean that family members are going to gang up or cause trouble, but rather it too often means that other employees use family groups as whipping posts for foremen. Employees feel that when a father and son, two brothers, or a husband and wife are employed in the same department that the family group gets breaks that are not offered to other employees.

This is not always true and circumstantial evidence sometimes puts the foremen on the spot. Occasionally the trouble that Ed speaks of will occur. Family cliques will gang up and cause trouble. Reprimand one and all the others in the family group will be up in arms. This leads to the establishment of the rules for not more than one member of a family to a department. Usually if only one member of the family is employed in the same department and the company allows employment of other members elsewhere in the company, no trouble will exist.

The idea of Al's that families will not be any more of a clique than lodge brothers is somewhat of a misleading statement. Al should know better . . . for a family is a very closely knit organization, built up by society for partnership. What affects one member of this society affects all the members and the reactions of one are usually borne out by the other members of the family. A group of lodge buddies have only one thing in common . . . lodge. Certainly they will usually speak up in defense or protest, but they won't fight so strenuously for a lodge brother and particularly not to the extent where it might involve loss of a job or prestige.

The society in which we live is based on survival of the fittest. It does not advocate the care of all humans to the extent of letting yourself fall by the wayside.

A workable arrangement is to keep members of the same family in different departments. This, of course, does not end all the struggles but it helps to keep them at a minimum. Don't play with fire if you can avoid it. It might not burn you, yet again you might suffer third-degree burns. If you are ever operating where two members of the same family are located in the same department, then be sure that you don't play favorites. Call a spade a spade and let the chips fall where they may.

Charles D. Townsend
Centralia, Mo.

•

From personal experience regarding relatives working together, I know of one company employing three brothers; two in the shop and one in the engineering department. These men are efficient and loyal workers and I have heard the owner express the hope that more of that family might seek employment with him. In my opinion, it is no more dangerous to have relatives working together than it is to have men of different ages in the same shop. As

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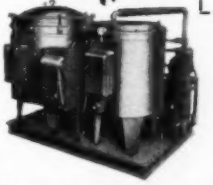

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Get accurate steel castings ... specify Unitcastings! Unitcast Corporation, Steel Casting Division, Toledo 9, Ohio. In Canada: Canadian-Unitcast Steel, Ltd., Sherbrooke, Quebec.

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ELECTRIC STEEL CASTINGS

long as the related applicant appears satisfactory, there should be no objection to hiring the third brother for the shop in question on the grounds that two of the same family are already employed by the company.

The company that has won the confidence, sympathy and appreciation of its employees and gives evidence that it is a good place to work need have little fear that relatives working together in the plant will tend to become a gang or pressure bloc. The organization which has created for itself the reputation of being a good place in which to work usually has established this reputation through its personnel policy as well as its methods of operation in the development of a satisfactory and satisfied working force.

The good reputation of a company is on the same plane as the good reputation of a family. The possibility of securing the best available workers of the same family rests on the general reputation that the company has built up. By the same token, the reputation of a family has equal bearing in the employment of its members by one company. The criterion for employment in the case of relatives should rest on ability and skill and not on number employed. Where relatives are already employed by the company and are satisfied, they are likely to recommend other members of the family. These recommendations may easily prove one of the best sources of supply of good workers since the employed workers know the plant conditions and are not likely to recommend the names of others, unless they feel that these will also be satisfied. In addition, a satisfied and loyal worker will not be interested in finding a job for a relative in disregard of that person's fitness for the job. He usually will know the reputation of the applicant for the job and will be glad to recommend a good man for the offered opportunity.

In any event, whether the applicant for the job be a relative of a present employee or not, it is in the interview with the applicant that the employment department of the company has one of the best opportunities to justify its existence. Centralization of employment work for the production forces in an employment department can be justified on the following grounds: although the foreman may have much knowledge of the detailed requirements of jobs, his experience and the time that he is able to devote is not such as to usually make him expert in the selection of workers; the foreman can-

not be expected to develop outside contacts as sources of labor in a way that a centralized department can; individual foremen are not in a position to perceive the needs of the plant as a whole, and thus the centralized department is more likely to achieve that uniformity in selection which makes for a generally high character of personnel, and to place an applicant in the department for which he is best suited. To make for soundness of selection, it is essential that the employment department personnel interviewing the applicant should have a firsthand knowledge of the requirements of the job, as covered by job specifications.

In addition to this qualification, it is of course essential that the interviewer be specially qualified in power of analysis, in knowledge of human nature, and in constructive imagination. An efficient personnel man can draw out the applicant on those points which are pertinent to a consideration of whether or not he is likely to be a permanent member of the working force. With the necessary information obtained, the selection of the worker will be made on a more equitable basis, both for company and candidate. It will not be based on the fallacious grounds of restricting employment of relatives. Experience has shown that the best way to make the shop "one big happy family" is to employ more members of happy families.

Harry Kaufman
Philadelphia, Pa.

•

PASSING THE HAT

The individual contributing system to secure funds for quick assistance to a fellow workman during sickness or sorrow is worthy and should prevail in all shops. Some small shops contribute to a fund for this purpose and when a set sum is reached, suspend collections.

There are others who maintain an organized committee to administer a fund for aid such as sickness and death. Also a flower fund for both sickness and death. A small fund in reserve for these instances is a great help in small shops where a quick call like flowers for funerals causes some difficulty in collecting a suitable sum to meet today's high flower costs.

However I have found employees give most freely in these emergencies while they frown on and turn down some organized charity lists.

They know that 100% is going direct to the party or to his assistance. I have acted on committees for plant

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For your convenience wherever you are, large and diversified bar stocks are maintained in thirteen great Ryerson plants. In Allegheny Stainless bars alone these stocks include several different kinds—in a comprehensive range of shapes and sizes. Rounds, squares, flats, hexagons and angles are on hand in the exact analyses to meet your particular service conditions or required fabricating characteristics.

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Also manufacturers of Swiss-Pattern files, milled curved-tooth files, rotary files and mechanics' hand tools.

welfare-sick relief and flower funds. I found that they carry a certain amount of cheer to the parties that is most helpful. Flowers to the sick from the shop has been known to pep up many a sick one when he beheld this mark of thoughtfulness and esteem. At the funeral these flower gifts from his or her shop-mates help to ease the sorrow of the relative because it came from the group instead of the individual. Then we often hear through friends of a sick or deceased person such as this: "Did you see what a nice floral piece or bouquet so and so's shop sent?"

My conclusion is that we need some movement in every shop large or small to take care of this matter. In this day of unemployment insurance, welfare departments, etc., we are not called on for actual want as in the past. So it's Christian and American to maintain this tradition in our shops today. I am glad Round Table brought this subject up so we could discuss it.

Henry Rasmussen
Niagara Falls, N. Y.

•

I doubt very much if factory managers would welcome being asked to furnish office help to handle an employee's Welfare Fund. Especially if supplementary to hospital insurance plans, where these are installed. Factory clerical help, which is "overhead," that is, not directly income-producing, is a big enough item now, without increasing this quantity. Office help is called upon to handle insurance records, deduction of union taxes withheld (social security and income), not to mention the different kinds of paper work connected with actual production of products, and so on, which is a lot of work.

To whom would a "Welfare Fund" be accountable? How would the employees know it is being used honestly and fairly? How would the employees like another deduction from wages? Even if consent were voluntary, the deduction can be assumed as an obligation after the first week.

Any variation in the amount collected by the solicitor appointed, for a donation to a needy person, is determined by the recipient's popularity and actual need, which is as it should be, it seem to me.

These voluntary donations are supposed to be inspired by human kindness. How can a cold-blooded business representative represent this human quality as it should be, with the proper warmth and feeling in what he does.

E. Diskavich
Torrington, Conn.

By establishing a definite welfare fund, under supervision by representatives of management and labor, a better device to serve the purpose intended will prove its superiority to discriminatory and variable hat passing in the shop.

In a large organization, the establishment of a properly managed welfare fund, that requires periodic crediting of amounts from all workers, will avoid the pitfalls which caused the idea of welfare work in general, by management, to fall into disrepute because of the attitude of some employers of saying "see what we are doing for you." A jointly run welfare fund will eliminate any semblance of this paternalistic attitude. Management should lend its support to this form of service work because it will aid the workers in being better able to carry on a worthwhile project and foster goodwill for the company.

The welfare fund should be administered for the workers by the company as follows: decisions on amounts to be collected and disbursed should be decided by representatives of the employees under the guidance of a representative of management. Management will find that it is worthwhile to aid in the establishment and operation of such a welfare fund not only on humanitarian grounds but because it serves to better labor relations.

It will be found that after study by management of the method of organization and administration of the fund that it will be less satisfactory to have it carried on by some branch of the personnel organization, perhaps the service department, than to have it organized as an employee activity, supervised by management. However, some company contact with the situation is necessary not only to give advice, where needed, but also to prevent the activity from degenerating into the football of opposing political camps within the employee group.

The company should not attempt to operate welfare funds itself, but it can urge the establishment of such funds and lend the time and experience of one or more of its executives to act as an advisor to such a group. The directors of a welfare fund should be almost entirely composed of workers, with possibly one or more representatives of management who will sit for the purposes named.

In one plant where such a welfare fund operated, we all paid a representative-collector of the fund a small fixed amount every month. Then, when the occasion arose re-

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quiring disbursement from the fund, our representatives determined what was fair and necessary to take care of the matter. Where everybody contributed the same amount at fixed periods, nobody had to carry more than his share of the burden. A schedule of fixed amounts paid in and out largely eliminated the old-fashioned inequitable method of "passing the hat" with its inevitable accompaniment of grousing, bad feeling and unsatisfactory collection.

Harry Kaufman
Philadelphia, Pa.

●

We don't "pass the hat" around anymore at our shop—after putting up with all of the usual gripes and dissatisfaction usually associated with hat passing, we put into effect the following plan:

Management advanced the initial capital with which an assortment of candies, soft drinks and smokes was bought at wholesale from a local jobber, who stops by once a week to replenish our stock. This merchandise is displayed on a rack just inside the tool crib near the "outgoing" window. The tool-crib attendant is charged with the responsibility of making sales and collections—sales prices are the same as prevailing local prices.

The men may purchase candy or smokes only when on a business trip to the tool crib—soft drinks are dispensed from a cooler placed outside the tool crib.

An accounting is made daily and the difference of sales over cost price of the merchandise is deposited in a welfare fund which is handled by the general foreman. Disbursements from this fund are made in accordance with a standard scale of donations based upon previous experience, so much for a wedding, so much for flowers, etc. Any special occasion or emergency is voted upon by the men during lunch period.

This plan is working well and management has been paid back its original advance. The fund is now of such size as to be able to meet any welfare problem which may arise without the need to pass the hat.

Henry George
Dayton, Ohio

●

There is in many cases someone in a shop that will start the plan of passing the hat and while many think that it is not the best way to handle such matters, yet they think that if they give voice to that feeling that it will make the impression that they may be contributing grudgingly and

that any discouraging word about the plan will not be taken as this one means it to have been.

During my shop career of over 40 years in shop work, from apprentice to master mechanic and engineering work, I have been in all types and ways of taking care of such matters in a number of shops. I now feel that the most satisfactory way to all concerned was where the workmen themselves had an organization formed for their group having an annual election at which time they elected a president, vice-president, secretary, and treasurer. There were small weekly dues and the president appointed a visiting committee for visiting the sick and disabled. This committee reported at each monthly meeting and at special meetings when such were required.

A modest payment was made weekly to those who were sick commencing at the beginning of the second week's absence and continuing for eight weeks. Weddings were considered a good investment and personal congratulations were considered sufficient.

At this time Reno had not yet made its reputation.

A floral tribute was sent by the visiting committee when there was a death among the membership or a member's immediate family.

H. B. Martin
Watervliet, N.Y.

•

Several years ago, we had an epidemic of illness in our department. Several of the employees were out for some time, and we passed the hat around to help them out. Everyone chipped in as much as he could afford, but it was not enough for the number of employees who were out.

When we talked this situation over with some of the men, we decided to set up in our own department a sick benefit, and accordingly called a meeting electing a secretary and treasurer. Each man paid so much a week and received $7 a week for loss of time while ill. In addition to this, we would often pass the hat around at the death of a man's wife or child or when any other unfortunate circumstance befell.

This sick benefit was successful for over a year, when the firm sent for the officers and inquired into our method and by-laws. The firm then adopted this plan for the whole plant, matching every dollar the men paid in dues and doubling the amount paid out. The employees elect their officials from each department, and after building up a reserve fund the balance is distributed equally among the employees who

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have not received any sick benefits during the year. Although not forced to do so, most new employees join the "beneficial," which is very popular.

As a sponsor of this beneficial, I will always feel proud of its success over a period of many years. However there are many other misfortunes such as the loss of a loved one, loss of a home, or other tragedies, when we feel we must help by passing the hat around. In this case we cannot help but feel the unfortunate person we are collecting for is only a name to the personnel department. In addition to this, I feel that the collecting should be done by an employee of his department who knows the circumstances and is a personal friend and everyday associate. Most personnel departments understand that the employees would rather do this in their own way.

I believe as Ed does that no foreman should object to the employees passing the hat around. There are several other reasons why it is better for the employees to collect in preference to the personal department: (1) employees are closer to each other, therefore more interested in each other; (2) a more friendly attitude toward each other and a better understanding as a group; (3) a desire to do something good in their own way; (4) the full coordination of the whole department; (5) the desire to be thoughtful of those people closest to each other; (6) a desire we all have to do something for someone we like and to help someone less fortunate than ourselves, and that good feeling we get by personally doing it ourselves.

A. E. Salmons
Philadelphia, Pa.

•

The subject of a Welfare Fund seems to be a sore spot with some members of any organization.

Generally, when a worker (and I refer to the rank and file, not those in any executive capacity) becomes ill, his income stops and he is either dependent on the handouts which must be collected from each individual member who wishes to contribute, or if fortunately a beneficial fund exists in the shop he is assured of a few dollars for a certain period of time.

Of course, if the employee is injured at work through any cause, and is forced to remain at home or be hospitalized, Workmen's Compensation helps to defray some of the expenses, although the money derived from this source is pitifully inadequate to compensate for lost earnings.

But, by and large, each worker is aware that once he cannot carry out his daily duties at his place of employment his wages cease, while his regular expenses continue, and he is under the additional burden of being compelled to pay incurred medical expenses over and above his compensation, such expenses sometimes running into quite a sum.

If, however, he has a savings backlog, his expenditures would not affect him too greatly; but although wages are somewhat high (particularly in certain trades), commodities and other essentials are higher in proportion, and tend to offset the high wage rate. Further, if by chance there should be any money left after meeting normal bills, taxes of every conceivable kind help to absorb it, so it is a rare family which is able to save an amount capable of tiding them over until the wage-earner's return to work.

In a way, too, we can look at the problem from a selfish viewpoint; that is to say, we could put ourselves in the other fellow's place and say to ourselves, "It might happen to us," in which event money from any source would be welcome.

Usually a shop steward or chairman or a seniority member is delegated to undertake the collection for a disabled member (or members, as the case may be), and meets with little or much success, depending on his eloquence, as well as on the good or ill will of the contributors.

It will generally be found that the objectors to this plan of collection will be those who enjoy seniority rights or who have not had any lost time on account of sickness; while those who have had the misfortune of being without funds in time of need realize the plight of less-fortunate fellow workers who must struggle along during illness until their earning capacity resumes, and are the ones most willing to donate.

Then, too, the argument is sometimes advanced that maybe the sick member has enough money set aside so that he really doesn't need the amount that would be raised in the shop. And one other disadvantage of the call-around is that the individual sum donated would vary from high to very little or none.

One solution which seems most fair would be for the personnel department to acquaint the workers with the advisability of donating a stipulated amount weekly or monthly, to be disbursed impartially to any employee absent after a specified time owing to disability.

This method of disbursement would more or less lack the personal touch, but it would eliminate the

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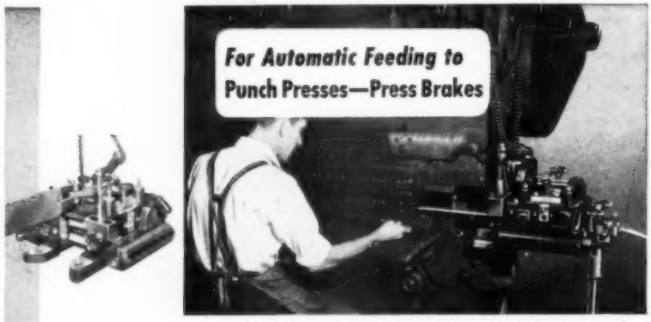

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griping that usually ensues from shop collection; and when inexorable expenses continue and must be paid for when they accrue, no matter what, or when a sick worker faces impending holidays with the cheerless prospect of no money to provide delicacies, the impersonality of the method of distribution would surely be overlooked by the recipient and be accepted with his perhaps unexpressed gratitude to all the donors.

Milton E. Sussman
Brooklyn, N. Y.

TO THE EDITOR

Off the Fence

With reference to the editorial note, "On The Fence" in Chips and Quips, Feb. 10, I am not on the fence.

Though specific cases are in some instances reapplicable, the technical progress of our continent does not result from duplication, but from use of wider knowledge.

On one side of our cold war, we have engineers and executives employing them and realizing the enormous capacity of the professional engineer for converting fundamentals into economical results.

The other belligerent is the fellow who is not skilled in creative imagination and does require his information in one-syllable form.

Since the contribution of the former to industrial advance is clearly larger than that of the latter, AMERICAN MACHINIST in providing extensible information is doing its best service.

Maurice Conklin
Hamilton, Ont.

•

More on 27 tpi

In the Practical Ideas section, *A.M.* February 24, there seems to be quite a controversy about cutting 27 threads per inch.

I have put in 32 years on tool and die shops (these were and still are modern shops), and I agree with Mr. Everett in some respects. All shops, even modern ones, do not have lathes as new as Cal Tech has. In my part of the country, toolrooms use quite a few Hendey lathes and seem well satisfied with them. One cannot cut 27 tpi on these lathes using quick-change gears, but, as every apprentice knows, they can be cut by changing one gear for another.

I heartily disagree with Mr. Moulton. I venture to say that our toolroom is just as modern as his, but that does not give me the privilege to say that tools, dies, gages and fixtures should be made only in a modern shop. I have seen wonderful work done in basement shops—some people can do excellent work with crude tools, and others can do some pretty rotten work with the best equipment.

Al. J. Lamprecht
St. Louis, Mo.

•

27 Threads Again

As an oldtimer, I was much amused when Jack Everett came out with his denunciation of modern lathes for not cutting 27 tpi used on pipe and small fixtures.

Some years ago I was sent out to another shop where there was a change-gear lathe to cut 27 tpi because my shop had no such lathe. On another job, some time later, I started to hunt up another change-gear lathe, but decided to do some brainwork instead. I found that the ratio between feeds and speeds on one of our lathes would give 27 tpi on one of the coarser feeds, with the lathe reversed and the feed locked.

This method of reversing the lathe may appear archaic to many of the boys now, but it was standard practice not long ago. When only a few threads are to be cut the method is quicker and cheaper than cutting a special gear.

However, a quicker way for short threads on pipe is to use a 26 thread with plenty of lubricant and force the parts together. This was done in another shop during the war, and passed inspection.

Some purists will probably yell their heads off over this method, but the difference between 27 and 28 tpi is less than the error I have seen in some threads cut by a lot of dies.

Charles Rankin
Ontario, Cal.

•

Shop Training in Schools and Colleges

This controversy (*A.M.*, April 7) brings up a subject which should be of vital interest to the entire machine-building industry and to concerns which use machines after they are built. The trend away from shop training in mechanical engineering colleges has not been in the best interests of the country. One great trouble with graduates of engineering schools has been their lack

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of first-hand knowledge of machine practice, even along elementary lines.

This has led to the designing of many machine products and parts which could not be made economically, if at all, on average machines. I recall one design submitted to the Navy during the last war which could have been made at a fraction of the cost if the designer had ever had any shop experience.

I have felt for many years that we would have much better mechanical engineering graduates if they had learned the machinist trade, or at least had a year or two of experience in the shop before going to college. This would make a background that would not only show them what they needed to learn, but would also make their studies more interesting by tying them directly to what they already knew was essential for their future success.

I realize that there are two major difficulties in putting such a plan into practice. Few young men can afford to go to college after learning the trade, and for various reasons. Many must have an income to support younger members of the family and at this time of life marriage often seems the only goal which is worth while. Then too the average young man has lost the study habit to some extent at least, and college lessons become very hard to master. But the few men I know who went to college after learning the trade have proved to be top-notch engineers.

There have been two defects in most college machine shops I have seen. They have antiquated machine equipment and the instructors have not kept abreast of the times as to shop practice. My old friend Samuel Gahan, who taught shop practice in a Brooklyn Trade School for many years, was a notable exception. He spent many of his vacations and his own money in visiting shops in various parts of the country to keep posted on late shop practices.

I do not, however, believe that *all* machines in a school shop should be of the latest design. There should also be some machines of various vintages such as the young man will find in the average plant in which he is likely to work. By knowing the limitations of machine tools 10 and even 15 years old he will not design gadgets that can only be made on the latest machines. For while we all like to see modern equipment in our shops, we know of many places where excellent work is done at an economical cost, on older machines, by men with practical experience,

gained from working with run-of-mine equipment.

In many cases it is well to have the young mechanic learn to overhaul machine-tool equipment as well as to use it in production. If he goes to work in the shop he will be more valuable to almost any employer. If he does not, he can direct men to keep the machine equipment in the best possible order to secure maximum production.

My only criticisms of an excellent trade school I visited in Mexico City some years ago was that all its equipment was new. After leaving, boys would go into shops with all kinds of antiquated equipment and in bad repair. They would have difficulty in producing acceptable work on them. I suggested getting some old machines of the types they would find in the average shop and teaching them to repair it, putting it in order for good work. Such knowledge and skill would assure them a warm reception in many shops.

Another point is that students should not be expected to memorize all rules and formulae. No engineer in practice attempts to remember all the formulae he uses. He need only know *how* to use them and *where* to find them in his books of reference. Forward-looking teachers long ago permitted their students to take reference books needed for examinations into the classroom.

Closely connected with shop work in colleges is the training program mentioned by Burnham Finney in the same issue. Too many managers seem to forget that the more automatic the production machines the greater skill it takes to keep them in condition for maximum production. The maintenance man who keeps machines in his charge in constant operation is worth far more than the one who simply repairs them after they break down. Many seem to overlook this. With this in mind some shops cut the maintenance man in on the production bonus of the departments in his charge. They realize that the fewer shut-downs the more valuable the maintenance man is and the more the men, as well as the company, will earn from the expensive equipment.

While the machine operator should get full credit for the output of the machines in his charge, it should be remembered that he is usually helpless when anything goes wrong with his complicated machine. Only the skilled mechanic can keep the modern machines producing wages for the operator and profits for the firm. And he should be given every con-

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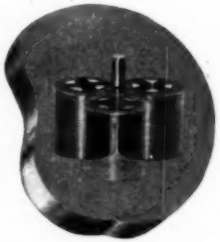

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sideration. Some find it advisable to put him on a salary rather than an hourly wage and to cut him in on the production bonus, as previously mentioned.

Fred H. Colvin

•

Suverkrop and Gage Blocks

I liked Henry C. Francis's letter in the March 10 *A.M.* regarding Suverkrop's joke about making gage blocks by acid etching. Old-timers' yarns based on father's wit seem to be pretty generally enjoyed. In such recollections of his sense of humor, his abhorrence of ostentation, and his general fairness and useful gentleness, Suverkrop gave us who remember him values no less important than his contributions to mechanical knowledge. Colvin's book "60 Years" seems to confirm that; it gives Suverkrop's character and wit more space than anyone else's.

Suverkrop had enormous patience for those less fortunate than he, and for honest beliefs and opinions of all people of whatever station. And as often as his keen satire punctured a stuffed shirt, his keen insight as to how a shirt first came to be stuffed occasionally made him hold his wit. He was indeed a man—a man to remember. But, as he at least subconsciously intended, his commonly remembered characteristics still tend to obscure the value of his serious contributions. I'm sure it will be agreed he deserves a few printed words about his serious side and the part he really played in the development of gage-block manufacture.

There is nothing terribly wrong in Mr. Francis's statement that Suverkrop's gage-making process "was similar to that devised by Hoke at Bureau of Standards in 1918" and that Suverkrop "afterwards made gage blocks but the venture was not a financial success." Merely by incompleteness are the implications incorrect. I rendered some slight assistance during father's development in the years prior to 1918, have the file of his papers, saw the work at the Bureau, and should be able to supply some hitherto unpublished facts to help complete the picture.

Suverkrop wrote the first paper published in the U. S. on the C. E. Johanssen gage blocks. It appeared in *American Machinist* about 1909, and may be read in Goodrich and Stanley's "Accurate Tool Work." Father was not only intrigued by the then-secret skill that could produce those beautifully simple gage blocks, but he frequently expressed the thought that if Johanssen patented

the method, industry would be more broadly served because of applications beyond gages. But the method continued a secret. I am sure it was both his admiration for the blocks and his desire to serve industry that led father to go to work on the problem.

At any rate, Suverkrop did solve the basic problem, constructed machines, made blocks, and applied for patents—all under his own steam and long before the work at the Bureau of Standards was initiated in 1918. The record shows that, instead of being merely "similar," father's and the method and machines at the Bureau were *identical in essentials* of (1) simultaneously lapping the opposite faces of the blocks between two laps, with (2) a means for limiting the closing together of the lapping surfaces. Although there was no essential difference in the process of making them, Hoke and the Bureau must be credited with the shape of the blocks; they had a circular section, instead of the rectangular shape that father favored and which has prevailed to this day. About the only other outstanding difference was that between the scale of the Government-financed work at the Bureau and father's modest operations financed by himself and help generously given him by his good friend Charles Taylor of Taylor & Fenn in Hartford.

Whether or not Hoke independently "devised" the method used at the Bureau without making use of the previously published Suverkrop patents, I have no way of knowing. But the record, including a complete original article signed on March 1, 1919, by the then chief of the Bureau's gage section, is very plain. It shows that Hoke's first letter to the Bureau was dated May 4, 1918, over two months after publication of Suverkrop's U. S. patents dated Feb. 19, 1918. (Suverkrop's British, Canadian, and French patents were issued later.) I recall the Patent Office references before issuing Suverkrop's patents, and as far as that Office was concerned he originated the mentioned essential of two opposing laps and the essential of some means for limiting the movement of those laps, both essentials disclosed by his patents for all to see.

Of course, these essentials may have been the basis of the process that had been kept a secret in Sweden but father, through his patents, was the first to disclose them to the world. The record shows that Hoke applied for no patent until after the Suverkrop patents had is-

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sued. The Bureau work doubtless contributed refinement in *details*, as is to be expected with the resources available to them. But regardless of such refinements by anyone, those essentials are, as far as I know, still the basis of precise gage-block finishing.

It appears from the record that Hoke brought neither sample blocks nor a machine with him to the Bureau for, with his arrival there July 1, 1918, "work was immediately started on the design of an experimental machine for demonstrating the manufacture." This "preliminary machine (was) developed by Mr. Hoke in collaboration with the Gage Section of the Bureau" and demonstrated successfully July 20.

In the meantime, friends who knew about father's work let him know what was going on at the Bureau and on July 12 he brought his patents to the attention of the Bureau. He offered the Government use of his patents at a very modest royalty. It was modest indeed because the royalty would have been far less than Hoke's salary as Major during the period. But that and father's other subsequent contacts amounted to a 1918 model of what in War II came to be generally known as the "Washington runaround," and finally ended with an invitation to "go ahead and sue." Unfortunate as it was, I suppose that normal human inertia and personal interests combined in determining to proceed without regard for the Suverkrop patents.

The record shows that on Aug. 8 the Government allotted $50,000 for this work at the Bureau. That, of course, provided for a much more elaborate program than anything my father could swing. Even so, the complete equipment was not available at the Bureau until Dec. 15, a month following the end of the war; and the first sets of blocks were not finished by the Bureau until months later, about March 1, 1919. On April 7, shortly after I got back from France, I saw the work at the Bureau and called on the patent section of the Ordnance Department. My inquiry respecting the Government's infringement of father's patents brought me a polite reminder (I was still in the Army) of a certain Article of War that prohibits anyone in the Army to give out information that "might be used in a claim against the Government." I should say here that the Bureau's March 1 article, long as it is, made no mention of father's prior work although its author was by then well acquainted with it.

After leaving *American Machinist* in 1919, under the name "American Standard Co." Suverkrop set up a plant in a corner of the Taylor & Fenn shop in Hartford. By early 1920 he had produced a considerable number of blocks, one set of which has been in use in my shop for years. Bureau of Standards test No. 29064 of July 12, 1920, records that Suverkrop submitted 64 blocks, of which four were marked "C.E.J." and the remaining 60 were father's product. The report gives lengths to the nearest 10 millionths (0.00001) inch. It records that the "C.E.J." blocks ranged from 10 millionths oversize to 40 millionths undersize, with none less than 10 millionths from nominal dimension. For the Suverkrop blocks the report gives zero error for 18 blocks or about 30% of the total, and the remaining ones were all within 10 or 20 millionths of size. It should be noted that Suverkrop had no such measuring equipment as existed at the Bureau and these blocks were submitted for measurement so that, in the same way the Bureau did with its product, blocks could be selected as suitable for sets.

The test indicates clearly that many of these Suverkrop blocks were superior to some of the Swedish blocks of that time, and equaled the accuracy of some produced by the Bureau. I think that is a remarkable achievement to have been accomplished by one individual with so little help, and with so much discouragement as the Bureau matter must have been to him. Father could never understand how the very Government that had granted him patents whose purpose presumably was to protect him could turn around and subsidize another individual in the infringement or development of those patents with so little regard for the rights or effort of the original patentee. Regardless of any legalistic "argument" that may be presented (I don't know what it might be), there is no question about this contributing to father's failing health and his untimely death in 1921. One of his patents was reissued Sept. 11, 1923. That his patents did indeed have value indicating priority is proved by the fact that his widow finally sold them for an appreciable sum to Arter Grinding Machine Co. in 1927.

As to "financial success," Suverkrop had none such as the benefit of a Government subsidy. His needs were simple and I think he got more out of life than many wealthier as well as poorer than he. And what does truly measure financial success? Maybe it would be simpler to

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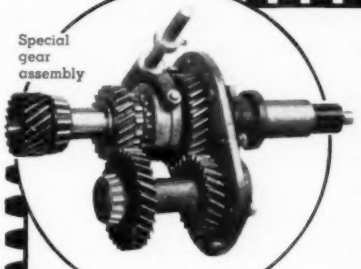

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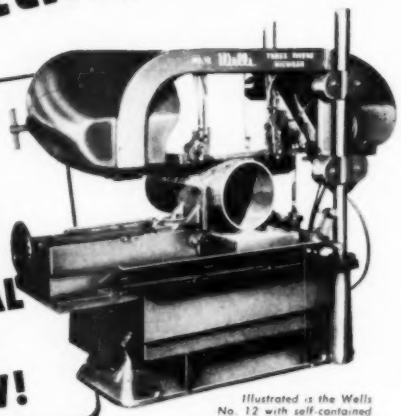

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leave out thought of financial or any other kind of success, and think back on Kipling's "If." Let's just say that the Old Man made a decent enough effort under some tough odds by his patents he "published" the first data giving essentials of making the gage blocks he gave generously to those needing help; and he left a lot of pretty good yarns based on his fine humor.

Lew Suverkrop
Bakersville, Calif.

•

Walker's Magnetic Chuck

Your story of O. S. Walker and his magnetic chuck recalled the first time I visited him when he was in charge of the small shop of the Norton Company at Barbers Crossing, when the magnetic chuck idea was very new. I had previously seen his twist-drill grinder, made at the Worcester Polytechnic Institute under the watchful eye of Milton P. Higgins, who was always most helpful and kindly to young editors, as I was at that time.

Here too I met John Bath, for the second time, when he had just launched his lathe test indicator on the market. I had seen him previously when he was a foreman in the shop of Amos Brainard, one of the pioneers in the milling-machine line, in his shop in Hyde Park. Few seem to know that Amos Brainard was the pioneer of climb or "in" milling, having patented a compensating nut for taking up slack in the feed screw, over 75 years ago. This visit to the Norton shop was the beginning of a warm friendship with John Bath which lasted during his life and which is continued with his sons.

Fred H. Colvin

NEW BOOKS

MACHINING OF METAL—*By Robert E. Smith, Ph.D., professor of education, Ohio State University. Published by McKnight & McKnight, Bloomington, Ill. 8x10½ in. 224 pages. $3.50*

Designed to give the student a broad, general knowledge of the operation of all the usual machines employed in metalworking, this book starts out with safety rules to be observed in school shops. Succeeding chapters deal with conventional measuring instruments and how to use them; tool grinders; drills and drillpresses;

lathes; shapers; milling machines; power hacksaws; band saws; and grinding machines.

Profusely illustrated, each section discusses the various types of machines available in that particular category, explains their principles of operation, and gives a step-by-step program for performing the full range of operations of which the machine is capable.

Vocational schools, in particular, will find this book of interest, as will home workshop enthusiasts, but it is not intended for production workers.

•

KINEMATICS OF MACHINES—*By Arthur F. MacConochie, professor of mechanical engineering, University of Virginia. Published by Pitman Publishing Corp., 2 West 45th St., New York City. 217 pages. Price $3.*

Designed for second- and third-year engineering students, this work handles a somewhat difficult subject in an easy, conversational vein that, nevertheless, covers the ground in a thoroughly competent manner. Each phase of the subject is clearly defined and liberally illustrated by diagrams and verbal comparisons with commonly understood applications.

Modern in every respect, the book reflects the ability of its author to hold the attention of an engineering class in the teaching of a subject usually considered somewhat dull. Each chapter begins with a simple explanation of the fundamentals of its subject and proceeds by graduated steps to its conclusion. Examples at the end of the chapters can serve as seven fortnightly problem sets.

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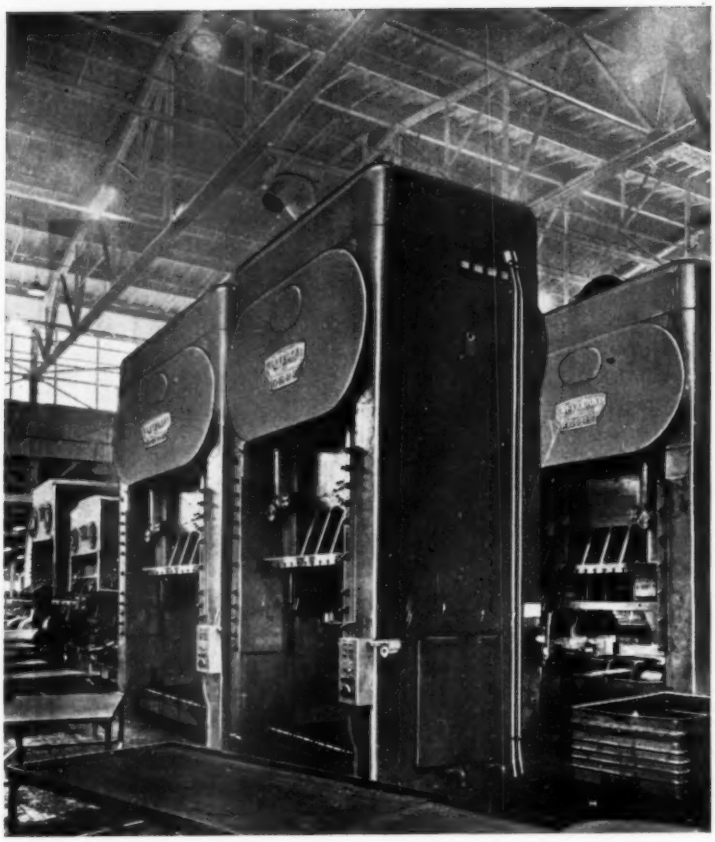

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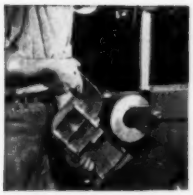

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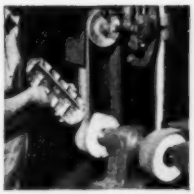

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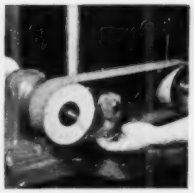

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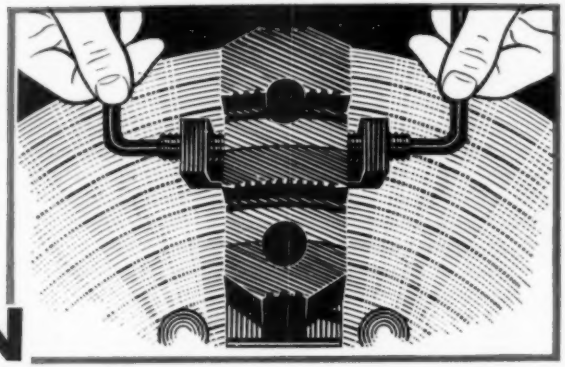

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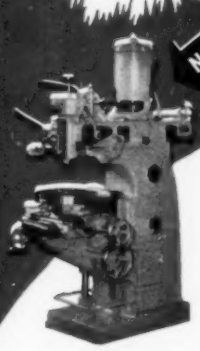

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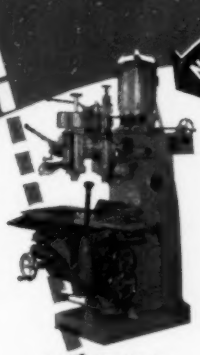

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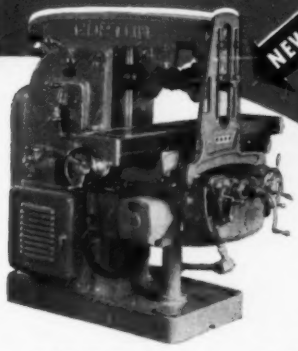

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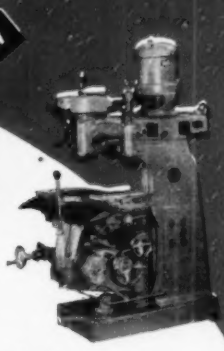

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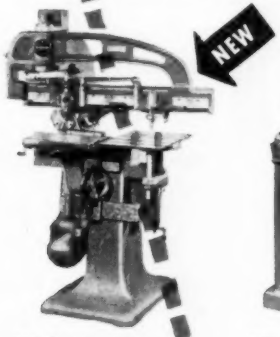
One of the most popular and practical die and mold duplicators ever built. Rugged in construction; has *Gorton super-speed spindle and sensitive controls for the most exacting work. Request Bulletin 1319.

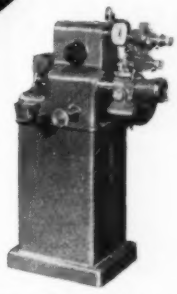
3-U Pantograph

The most used 2-dimensional pantograph in the metal-working field. Sturdy and rigid with sensitive tracer control. Larger and heavier 3-Z model also available. Request Bulletin 1380.



P13 Pantograph

The Gorton †Ratiobar Pantograph for 3-dimensional work offers the first basic design improvement in pantograph construction. Simpler to operate, more rigid, and accurate for small dies, molds and hobs. Easily converted for 2-dimensional work. Request Bulletin 2310.



375-2 Cutter Grinder

Universal type bench or floor models; capacity up to ⅜" dia., including ball nose and multi-flute cutters of almost any diameter, taper, shape or clearance. For carbide cutters, diamond wheels are used. Choice of tool heads and attachments. Request Bulletin 1317.

16-B Automatic Lathe

For precision turning of long slender parts from .005" dia., by 1/32" long to 7/16" dia., by 2¾" long. This Gorton Swiss-type Automatic solves many precision turning problems. Request Bulletin 1800.

*Trade Mark
Reg. U. S. Pat. Office

†Pats. Applied For

GEORGE GORTON MACHINE CO.

1505 Racine Street, Racine, Wisconsin, U.S.A.

Please Send at Once

For brief facts about the Gorton line of tracer-controlled machines, use coupon or company letterhead and request Bulletin 1655 illustrated above. For specific information on certain machines, see text accompanying each illustration.

Name.....

Title.....

Address.....State...

Dept. 1505

NEW PROVISION FOR **PRECISION** ON MULTIPLE SPINDLE MACHINES

Scully-Jones Micro-Nut used on Adjustable Adapter in Multiple Spindle—Note Mark on Spindle to Facilitate Accurate Adjustment.
Graduated to permit Adjustment to within .001.
Set-Screw Does Not Touch Threads—Prevents Thread Damage.

SCULLY-JONES

MICRO-NUTS*

You make "Precision" Adjustments—Now you can make really accurate adjustments on Multiple Spindle Machines to .001 in., by scribing a mark at any point on the Spindle (see illustration) and turning the easy-to-read, calibrated Scully-Jones Micro-Nut in the direction required.

You Save Set-Up Time—You simply give a quarter-turn to the set-screw, to lock Scully-Jones Micro-Nuts in place at any location on the thread of the Adapter. Note diagram showing that screw *does not touch* threads.

Keep Inventory Down—Your requirements will be filled immediately from our stock of all sizes for Adapters with "Acme" and "V" threads. Write for bulletin giving further details and prices.

R-2847RR

For Both Types of Threaded Adapters—You can use these low-cost Micro-Nuts on your present Adapters with or without set-screw slots.

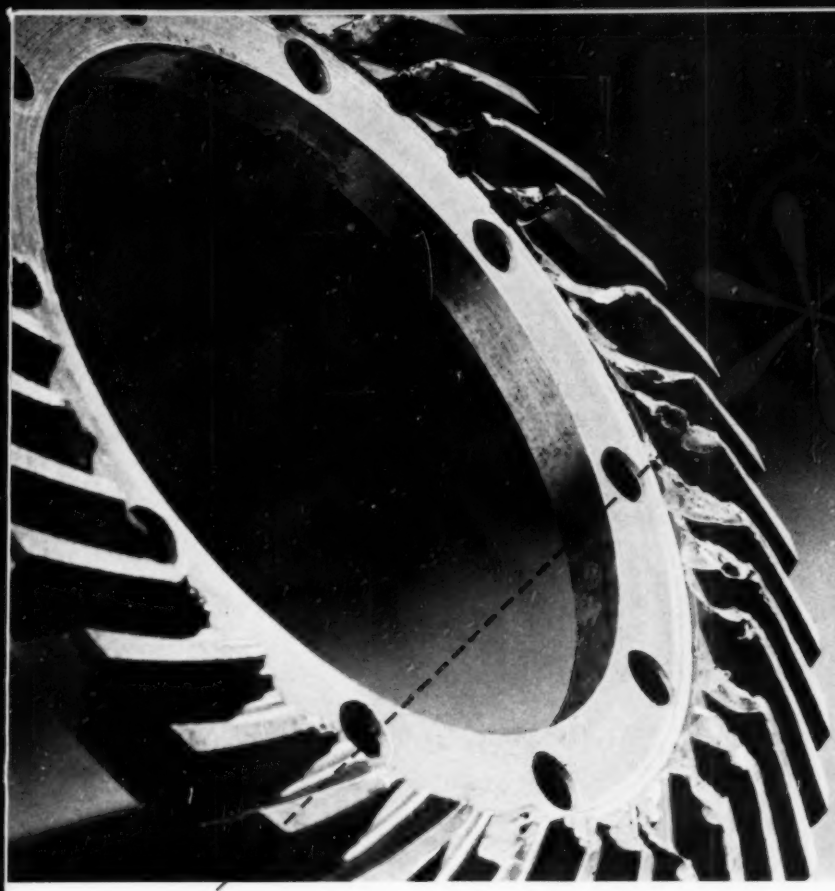
Make Same Range of Adjustments—You can make the same range of adjustments, between spindle and work, with Scully-Jones Micro-Nuts as you do with standard solid adapter nuts.

Nothing to Get Out of Order—You will like the simple, trouble-free one-piece design, with vapor blast finish. Scully-Jones Micro-Nuts are machined and hardened to our high quality specifications, to assure you the service demanded by modern, high-speed production.

Scully-Jones AND COMPANY

1902 S. ROCKWELL ST.
CHICAGO 8, ILLINOIS

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS



The Inside Story of a Pinched Penny

THERE is no economy in a cheap gear. On the contrary, a pinched penny may purchase untold expense—plus headaches without number.

That is why we specialize in gears—"Double Diamonds"—that possess *true* economy. Economy expressed in terms of lowest *final cost*—including installation *and* performance.

It takes a little more time to make "Double Diamonds"—and considerably more experience, care and skill. But when they're done, we're proud of them. And because they contribute so substantially to the life, the performance, and the continued efficiency of your product, you'll be proud of them, too.

Manufacturers interested in gears that are built to show lowest final cost—who have an eye for long-run economy—are requested to write for information.

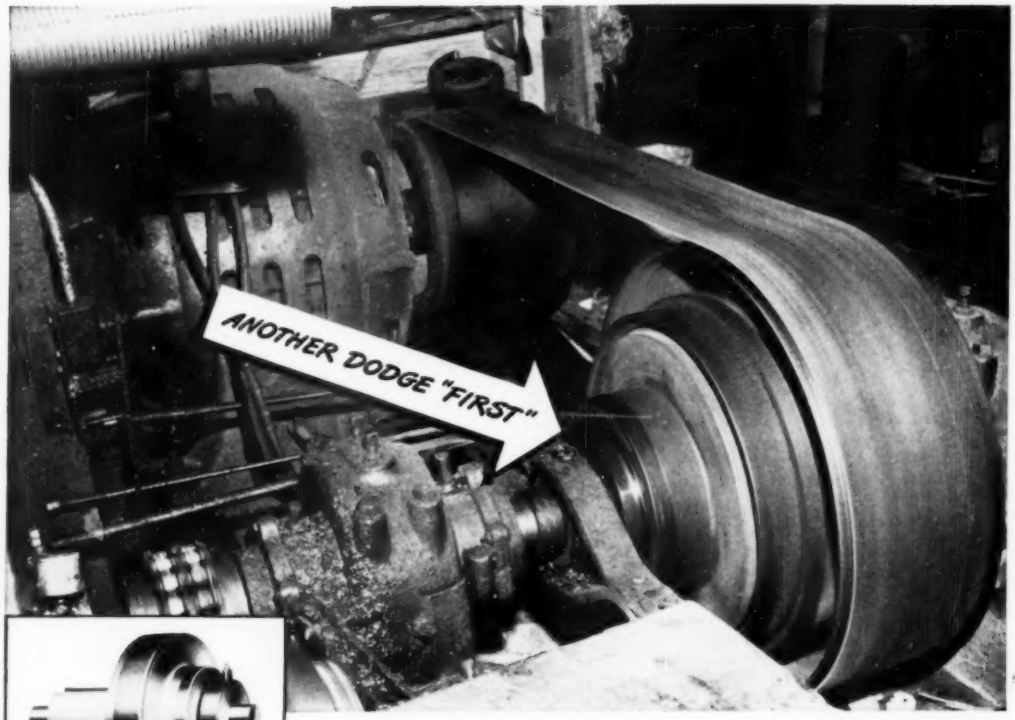
DOUBLE DIAMOND
TRADE MARK
GEARS

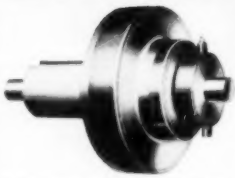
Made by
Automotive Gear Works, Inc.
RICHMOND, INDIANA

• • • • • FOR AUTOMOTIVE FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS • • • • •

☆Reg. U. S. Pat. Off.

HYPOID BEVEL · SPIRAL BEVEL · FLYWHEEL GEAR · ZEROL☆ BEVEL · STRAIGHT BEVEL · STRAIGHT SPUR · HELICAL SPUR · SPLINE SHAFT





Over 50 years of experience in the manufacture of industrial clutches have gone into the development of the famous Dodge Diamond D Friction Clutch – noted for its ruggedness and simple, one-point adjustment.

"SHOCK" TROUBLE?

Here's one way to lick it!

HERE A Dodge Diamond D Clutch takes the tremendous shock loads of a veneer peeler lathe. Huge logs are revolved and "peeled" by knives, with 150 to 200 engagements per hour! Precision-built clutches, capable of performing dependably where profits depend upon uninterrupted operation, are another Dodge "first"—one of many Dodge "firsts" in the field of power transmission machinery.

For information on how Dodge products can improve machine performance, save power and keep production steady, call the Transmissioneer, your local Dodge Distributor. He has information on new and better developments for the mechanical transmission of power.

DODGE MANUFACTURING CORPORATION • MISHAWAKA, INDIANA

TAPER-LOCK SHEAVE
Simplest, surest mechanism ever devised for holding wheels to shafts.

DODGE-TIMKEN BEARINGS
save power on millions of industry's toughest jobs.

ROLLING GRIP CLUTCH
No toggles! Compact. Extreme flexibility with positive drive.

TAPER-LOCK FLEXIBLE COUPLING
Available from stock ready to install *without reboring!*

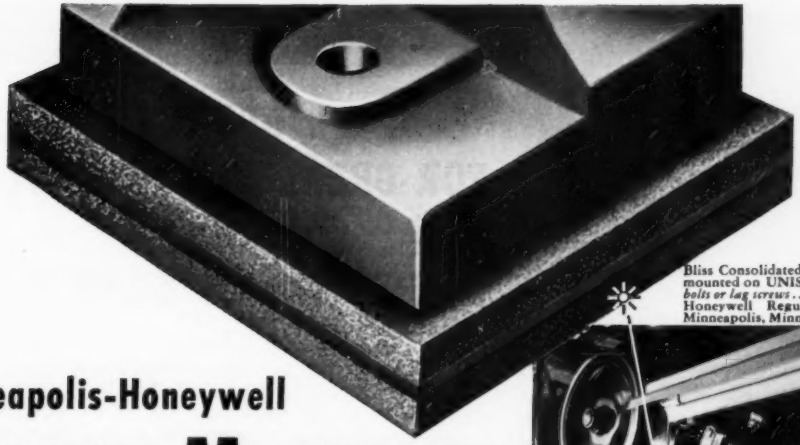
FIRST IN POWER TRANSMISSION MACHINERY!

DODGE
of Mishawaka, Ind.

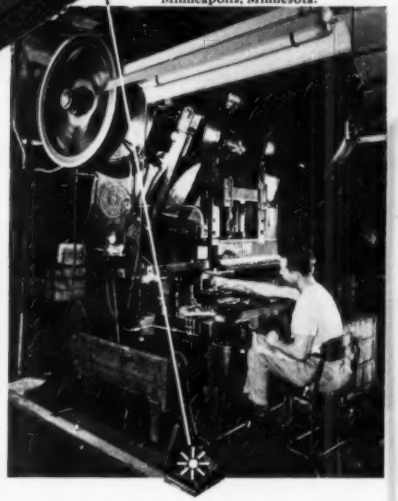
CALL THE TRANSMISSIONEER
– graduate of a Dodge factory course, qualified to help on your power transmission problems. Look for his name under "Power Transmission Equipment" in your classified telephone book

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS



Bliss Consolidated #8 Punch Press mounted on UNISORB . . . *without bolts or lag screws* . . . at Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota.



Minneapolis-Honeywell

MOUNTS MACHINERY ON UNISORB

. . . Drilling avoided . . . floors saved!

Here's why one of the biggest names in industry anchors practically every kind of machine on floors of every construction in the modern way . . . *on UNISORB!*

TRANSMITTED MACHINE NOISE AND VIBRATION REDUCED 60% to 85%

Lowers machine and building maintenance costs.

Higher speed machine operation often possible.

UNISORB ANCHORING REQUIRES NO BOLTS, NO LAG SCREWS

Old-fashioned, destructive floor drilling eliminated.

Saves installation time as much as 80%. Labor costs reduced.

Maintenance on machine mounting practically eliminated.

Clip this coupon, or write us on your letterhead today.

LOOK FOR THE RED CENTER AND UNISORB BRAND MARK

THE FELTERS COMPANY

210-N SOUTH STREET, BOSTON 11, MASSACHUSETTS

Offices: New York, Philadelphia, Chicago, Detroit, Cleveland
Sales Representatives: San Francisco, St. Louis
Mills: Johnson City, New York; Millbury, Mass.; Jackson, Mich.

Gentlemen: Please send my free copy of "Why It Pays to Anchor Your Machines with UNISORB." ( )

Please send my free copy of "Felters Precision Cut Felt Parts Manual." ( )

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COMPANY NAME .....

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BE GEARED
FOR GREATER EFFICIENCY
with
BAUSH WORM GEARING
The name Baush is a hallmark of quality in American industry . . . Whether it be a gear or a costly, custombuilt machine, the name Baush assures dependability, efficiency, economy and superior performance . . . For instance, on Baush worm gearing, shell worms and worm shafts have hardened and ground worm threads . . . Both the composite and all bronze type worm gears are hobbed to close tolerances.
We maintain over 500 Worm Gear Hobs to design around, thus eliminating considerable tool charges to our customers. Worm gear sets range from 2 1/8" to 28" center distances covering up to 2" circular pitch.
Manufacturers of Speed Reducers, Industrial Trucks, Tractors, Conveyor Systems, Agitating Equipment, Diesel Engines, Automatic Screw Machines, etc., are assured all items are subjected to 100% inspection for tooth contact, center distance and Rockwell Hardness before release.
To be geared for greater efficiency, you can depend on Baush.
1. Steam Turbine
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3. Truck Axle
4. Agitator Drive
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6. Motor Truck
7. Lift Truck
8. Diesel Engine
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10. Speed Reducer
11. Turbine
12. Special Machine
13. Pump
14. Hoist
15. Agitator Drive
16. Screw Machine
17. Agitator Drive
18. Agitating Equipment
19. Diesel Locomotive
BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

LOOK AT THIS PRESS

It's designed to provide industry with low-cost, high production units that are highly flexible in design and operation . . . relieving heavier presses of short runs and lighter work. Presses are practically fool-proof in operation. Frame is extremely rugged. Fingertip controls are conveniently located at hand level. Available for immediate delivery, in standard width (between uprights) of 24"—31"—36"—42" respectively. Available in special width up to 72" at small additional cost. Movable bed plates. Pumping unit has by-pass relief valve which can be set at any pressure up to press capacity. Presses available for either vertical or horizontal operation. *All Standard* presses equipped with 2-speed built-in hand pumps for more sensitive and versatile operation.

READ THESE "SPECS":

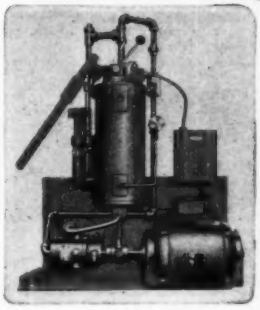
CYLINDERS: *Standard Models* furnished with 6" bore, 7½" stroke—spring return type; also 5" bore, 7½" stroke—spring return type. Above presses are *standard*. Following can be furnished at additional cost: Double Acting, 6" bore, 7" stroke; 6" bore, 11" stroke; 5" bore, 7" stroke; 5" bore, 11" stroke. Special long stroke cylinders also available, up to 48" in length, for incorporation in suitable press frames of our make.

PUMPING UNITS: These units can be supplied in various volumes and pressures, in a total of 13 combinations.

Presses include V blocks, Gauge, Motor Controls, Pressure Regulator, etc., complete and ready to attach to electrical source.

CHECK THESE USES:

There are so many everyday production uses for these versatile KRW Hydraulic Presses that we have lost count. Here are a few of the more obvious . . . blanking, forming, bending, broaching, straightening, stamping, embossing, numbering, upsetting, laminating, pressing and hot or cold forging. KRW Engineers are daily developing other uses. If you have only a vague idea of how these presses might be used in your plant, let us have it in a rough form. We'll do the rest.



MODERNIZE AND MOTORIZE YOUR PRESENT KRW PRESS with one of these compact motor drive units. They come complete ready to connect to your press. Require very little extra floor space. Write for conversion unit prices, giving the capacity and serial number of your press.

BEAT THESE PRICES*:

Depending upon capacity of pumping equipment, prices of Standard model motor driven hydraulic presses are as follows, F. O. B. Factory: 25-ton press from $727.00 to $992.00. 50-ton press from $806.00 to $1058.00. 60-ton press from $1070.50 to $1135.00. 75-ton press from $1198.00 to $1258.00. All motors in the above units are 220/440 volt, 3 phase, 60 cycle. Any change in motor specifications is extra. **Subject to change without notice.*

MAIL THIS COUPON

It will bring you all the money-saving facts about these low cost, high production hydraulic presses. Now is the time to get ready for the highly competitive days ahead.

K. R. WILSON, 215 Main St., Buffalo 3, N. Y.

Please send me complete information on KRW Motor Driven Presses as follows:

☐ 25-ton ☐ 50-ton ☐ 60-ton ☐ 75-ton presses

☐ motor drive conversion unit ☐ Press Cap.

Serial No. .....

Name .....

Address .....

City and Zone ..... *State* .....

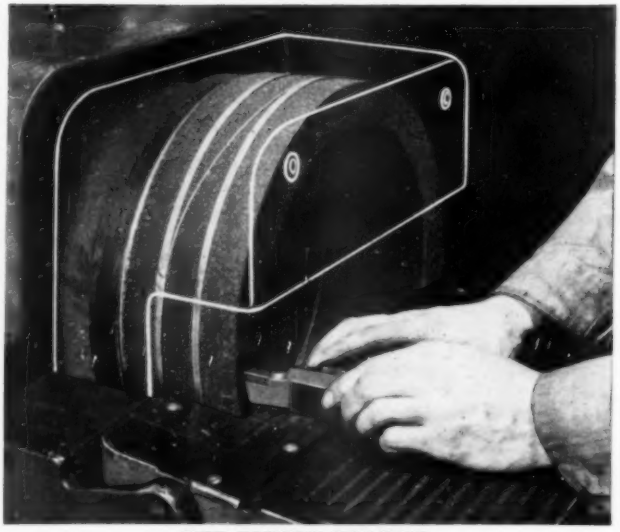
K·R·WILSON

215 MAIN ST. · BUFFALO 3, N. Y.

BUXITE

GRINDING WHEELS FOR CARBIDE TOOLS

LIGHTER FEED... COOLER CUTTING



THE BUXITE PROCESS

(Formerly Controlled by The Bridgeport Safety Emery Wheel Co., Inc.)

The Buxite Process is a revolutionary method of coating **each individual grain** of Buxite wheels with a microscopically thin shell of carbon in an isotropic vitrescent form. Each shell permits its grain of abrasive to turn, exposing every cutting surface before it is worn away. Each succeeding layer of grains are contained in their individual carbon shells, assuring constant grinding action during the life of the wheel.

REPRESENTATIVES NOTE: There are a few desirable territories available to well qualified representatives. If you are interested, write us, giving full particulars of your operation and qualifications.

Buxite grinding wheels perform better and actually cut faster with light pressure. This means that carbides and other superhard steels can be ground with less heat being generated . . . which prevents checking and cracking, lengthening the life of the tools.

GRIND CARBIDE TOOLS AT 75% TO 85% LESS COST

Not only do Buxite wheels increase carbide tool life, but they give a cleaner grind and better finish. Buxite wheels do not "load" when grinding sintered tools, eliminating frequent stops for dressing, and the hard-shelled grains makes the life of each Buxite wheel 4 to 6 times that of ordinary wheels.

REDUCE DIAMOND WHEEL CONSUMPTION

The lighter cuts and cooler grinding action of Buxite grinding wheels results in excellent finish on Tungsten Carbide and other types of superhard alloys. Buxite wheels always reduce and frequently eliminate the need for diamond wheel grinding on this type of tool. This saving in diamond wheel consumption and costs is an important reason so many manufacturers and metal working shops have standardized on Buxite wheels for their tough grinding operations.

ADDITIONAL ADVANTAGES OF BUXITE WHEELS

Every feature of Buxite wheels contributes to faster production and lower piece cost on grinding operations involving super-hard tool steels. Faster, cooler cutting action, longer tool life, longer wheel life and reduction or elimination of diamond wheel consumption result in greatly lowered costs. If our representative has not called recently, write direct to us for additional information and money-saving facts.

MANSCO GRINDING WHEEL CO.

2164 EAST 36TH STREET — CLEVELAND 15, OHIO

Exclusive Suppliers of BUXITE *Grinding Wheels*

KHP

Precision

SPRING STEEL

KHP *precision* Spring Steels are available in both annealed and tempered grades, in a carbon range of .50 to 1.00. Choice of finishes in blue, straw, and mirror bright. Thicknesses from .0015 to .125 in tempered, and from .005 to .1875 in annealed. Also Feeler Gauge steels in all thicknesses. To assist you in the most economical application of KHP Spring Steels, the cooperation of our metallurgical department is freely at your service.

KHP PRODUCTS ARE: Cold rolled and hot rolled strip—shim—sheet steels • Annealed spring steels • Tempered and polished spring steels • Tempered feeler gauge steel • Cold finished bars • Drill rod • Electrical sheets • Precision tubing—cold drawn seamless—welded—stainless and alloy tubing • Aluminum strip and sheets • Extruded aluminum and magnesium tubing—shapes—mouldings • Rolled magnesium plates • KHP SERVICES: Edge rolling • Slitting • Square shearing • Flattening, straightening, cutting.

KHP STEEL

KORHUMEL • HEFFRON & PREISS STEEL CO.

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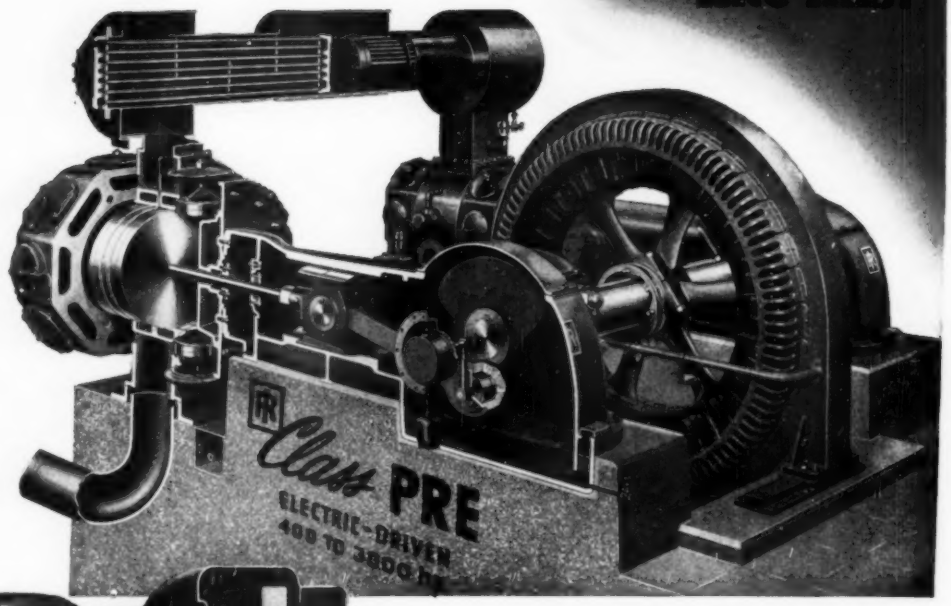
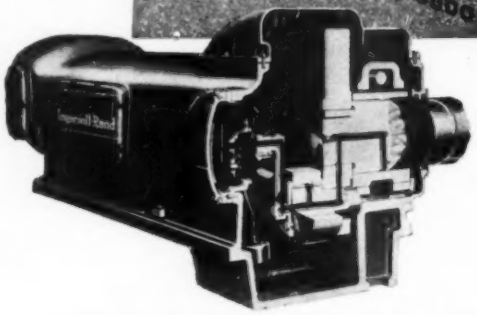
WAREHOUSES: MINNEAPOLIS • MILWAUKEE • MT. VERNON, N.Y. • SALES OFFICES: DETROIT • ST. LOUIS • LOS ANGELES

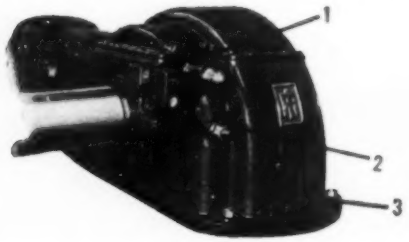
only Ingersoll-Rand makes a compressor like this!





Oil-pump drive and distribution system (patented) are combined to feed filtered oil directly to the crankpin, main bearings and crosshead.

Convenient Oil-control Center showing (1) main-bearing temperature indicator, oil-pressure gauge, and automatic oil-pressure protection, (2) main-bearing micrometer adjustment, and (3) oil filler cap.



Look at this full force-feed, filtered, lubrication system built entirely within a *sealed* crankcase which has no oil piping under pressure and no internal bearing adjustments. The machine *stays* clean inside . . . is *easy* to clean outside. Crankpin and crosshead-pin bearings are *full-floating*, precision-type, and pressure-lubricated. Main bearings have *micrometer* adjustment from *outside* the crankcase.

The PRE is equipped with Ingersoll-Rand's Air-Operated 5-Step Clearance Control, conceded to be the best method of regulating the output of large synchronous - motor - driven compressors. Efficient *Channel* Valves and economical *two-stage* intercooler reduce power cost and cut maintenance.

Let us tell you more about the "PRE" . . . the heavy-duty compressor in a class by itself. And remember, Compressors and Air Tools pay for themselves nearly twice as fast today.

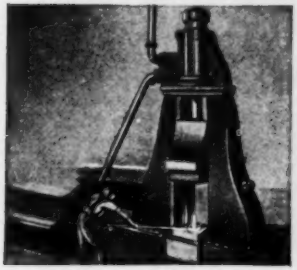
Ingersoll-Rand

11 Broadway, New York 4, N. Y.

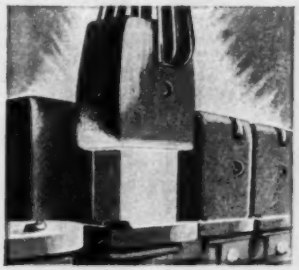
AIR POWER
The Key to Lower Production Costs

344-1

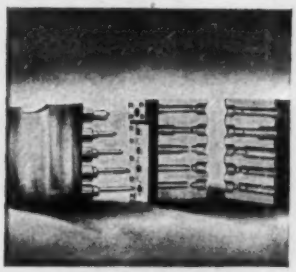
When the HEAT'S on...



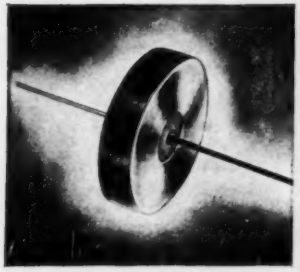
FORGING



STEEL INGOT STRIPPING

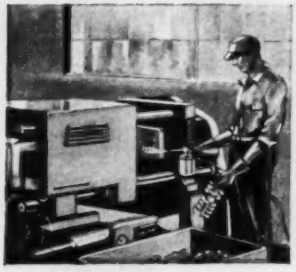


DEEP PIERCING



WIRE DRAWING

STRETCH FORMING



DIE CASTING

"dag" Colloidal Graphite Keeps 'em Lubricated!

At high temperatures . . . 400°F. and up, where ordinary lubricants begin to fail . . . **"dag"** colloidal graphite dispersions lick friction and keep parts lubricated for action.

"dag" colloidal graphite is not just ordinary graphite. It is graphite which has been processed scientifically so that its particles are usually less than .000039 inch in diameter!

This means that when colloidal graphite is applied to the friction surfaces of metal it leaves a lubricating film so thin that even the most sensitive gages cannot detect it. The film is many times more durable than an oil film. It provides the metal with a graphoid surface that has an extremely low coefficent of friction, that resists oxidation, and that will function at temperatures far above the burning point of oil.

Acheson Colloids engineers are anxious to help you with your lubrication problem. Call the local representative, or mail the coupon TODAY for more information on **"dag"** colloidal graphite dispersions.

Acheson Colloids Corporation, Port Huron, Mich.; Boston; New York; Philadelphia; Pittsburgh; Cleveland; Detroit; Chicago; St. Louis; Los Angeles; San Francisco; Toronto.

dag COLLOIDS

ACHESON COLLOIDS CORPORATION
Port Huron, Michigan

☐ Send me more information

☐ Send a sales engineer at my convenience

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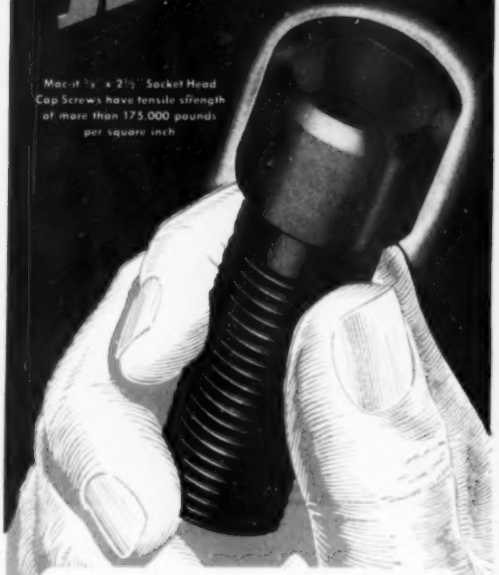
E-15

IT'S A

Mac-it®

PRONOUNCED "MACK-IT"

Mac-it ⅜" x 2½" Socket Head Cap Screws have tensile strength of more than 175,000 pounds per square inch



BETTER, FASTER SERVICE WITH THIS *COMPLETE* MAC-IT LINE!

Because many standard types of Mac-its are stocked throughout the country for quick delivery, and because specials can be engineered to your own specifications, you'll find it pays to investigate Mac-its *first.*

Mac-it's 35 years' experience in the manufacture of heat-treated, alloy steel screws is your assurance of precision, uniformity and strength. Sold through leading industrial distributors from coast to coast and in Canada. Write for new catalog today!

Other Mac-it products include:

Hollow Lock Screws
Hollow Set Screws
Stripper Bolts
Hollow Pipe Plugs
Socket Screw Keys
Square Head Set Screws
Hexagon Head Cap Screws
. . . and many others

Marketed Nationally Since 1913 by

STRONG, CARLISLE & HAMMOND COMPANY

Cleveland 13, Ohio

Manufactured by MAC-IT PARTS COMPANY, Lancaster, Pa.

weigh it
say it
spray it

it's easier with Abbott
the all round ball

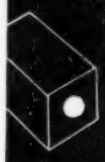
Scales, dictating machines, spray equipment . . . more products whose operating efficiency is dependent upon Abbott Bearing Balls. Abbott's well rounded line is so diversified that not only is there a size ball for every product, but also a size, tolerance and a sphericity range of that ball for use in various grades of the product. The chart below gives a quick picture of Abbott's line. See if it doesn't have the ball you need.

A-B CHART

GRADE	SIZES	Size Tolerances	Sphericity Within
Abbott A	1/16 — 5"	± .0001"	.0001"
Abbott B	1/16 — 5"	± .0002	.0002
Abbott C	1/16 — 5"	± .0005	.0005
Abbott Hardware	1/16 — 5"	± .001	.001"
Abbott Industrial	1/8 — 5"	± .002	
Abbott Special	1/8 — 5 11/32"	± .003	
	11/32 — 5"	± .005	

ABBOTT

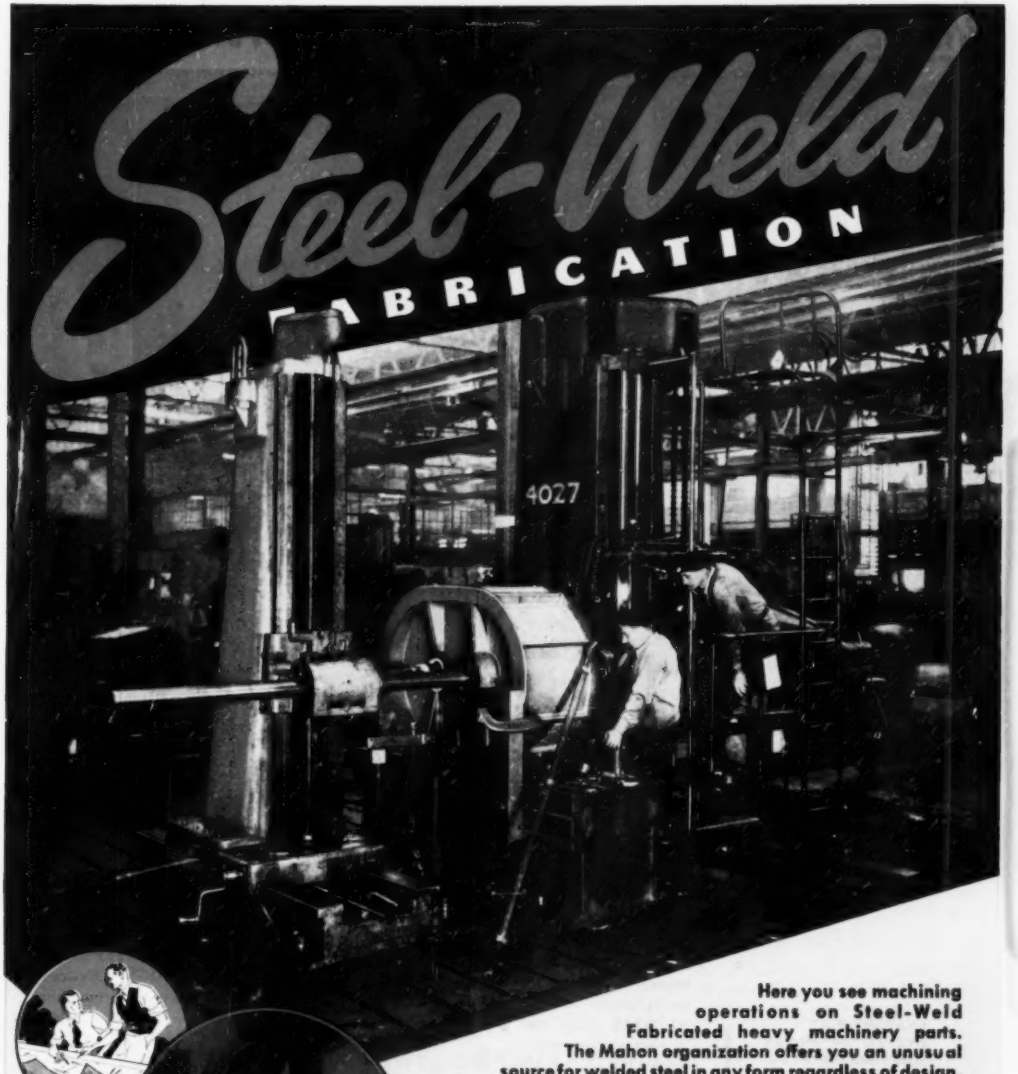
THE ABBOTT BALL COMPANY
HARTFORD 10, CONN.



P.S.
The round hole in the square peg can help you with your burnishing problems, too. Ask for a sample kit.

Steel-Weld

FABRICATION



Here you see machining operations on Steel-Weld Fabricated heavy machinery parts. The Mahon organization offers you an unusual source for welded steel in any form regardless of design, size, or weight . . . a source with complete facilities for producing, magnetic inspection, stress analysis, normalizing, grit blasting, machining, and spray painting. These facilities, backed by a staff of design engineering experts and highly skilled craftsmen, are your assurance of a better, smoother appearing job, embodying every advantage of Steel-Weld Fabrication.

•

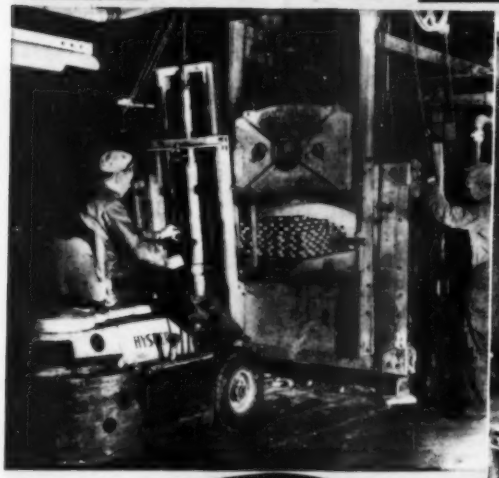
THE R. C. MAHON COMPANY

DETROIT 11, MICHIGAN

Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

MAHON

INSIDE YOUR PLANT...OUTSIDE IN YOUR STORAGE YARD



with a Hyster® "20" LIFT TRUCK

THE SAME TRUCK — the rugged, dependable "little" work horse, the HYSTER "20" — operates EQUALLY AS WELL *inside your plant* AS *outside in your* storage yard.

HEAVY DUTY INDUSTRIAL TYPE PNEUMATIC TIRES give the Hyster "20" greatly increased traction, ramp climbing ability, cut down on floor and paving repair and maintenance costs, make higher truck speeds more practical and safer, are easy on the load and driver — EITHER INDOORS or OUTDOORS.

HYSTER "20" HAS GREATER MANEUVERABILITY because of Hyster's patented turning counterweight around the trunnion mounted rear steer wheel; low center of gravity which increases stability; easier steering, rounded rear end.

THE MOVEMENT OF MORE MATERIALS in crowded areas — EITHER INDOORS OR OUTDOORS is done *quickly, efficiently* with the Hyster "20" (2,000-lb. capacity).

CURRENT DELIVERY . . . See your Hyster distributor. Write for literature.

REASONS WHY HYSTER "20" MOVES MORE MATERIALS...

- ✓ Pneumatic tires.
- ✓ Powerful air-cooled gasoline engine.
- ✓ Maximum operator visibility.
- ✓ Load-Grab — For handling many loads without pallets.
- ✓ Special Load-Grab arms available for handling bales, boxes, bundles, bags, barrels, oil drums — without pallets.

Hyster's 7 models range from 2,000-lb. to 30,000-lb. capacity. All are equipped with pneumatic tires.

HYSTER COMPANY

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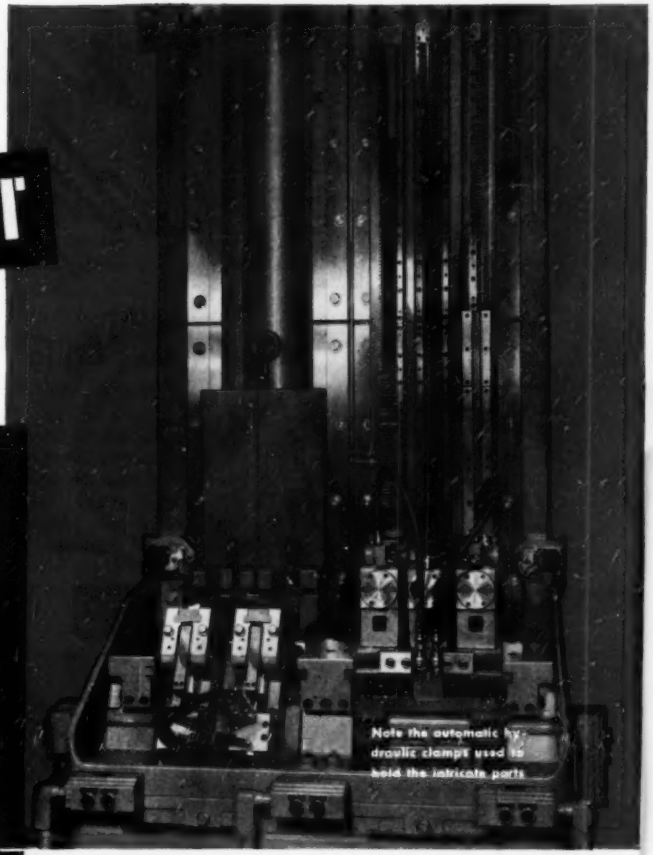
HYSTER

How we Multiply Production is NO SECRET

...BUT WE'VE GOT THE RABBITS GUESSING!



Note the automatic hydraulic clamps used to hold the intricate parts

Every part is perfect,

FASTER THAN RABBITS CAN MULTIPLY...

Rabbits are noted for their production rate—but this LAPOINTE Double Ram Vertical SURFACE BROACHING MACHINE has 'em stopped in their tracks!

Here's the proof: In a plant making shot guns, *one Lapointe broaching machine* is now producing a hammer, trigger, and catch at the rate of *280 of each per hour!* Formerly the hammer required 8 milling and 3 burring operations; the trigger, 4 milling operations; the catch, 3 milling and 2 burring operations. And here's the BIG news: *By changing to broaching,* the production rate per hour jumped 300%!

How much could you save in time, money and *floor space* on certain of your own high-production requirements? Our new bulletin may give you some ideas! Send for DRV 500-2.

THE *Lapointe* MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory • Edgware • Middlesex • England

HUDSON LAPOINTE MASS.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

For Maximum Productivity...

New Model BAKER Hydraulic Drill

Baker Standard Model 17HO vertical hydraulic feed drilling machine is designed to afford a variety of spindle speeds, and is adaptable to single or multiple spindle operations. Other features include: pick-off gears providing spindle speeds from 40 to 1575 RPM . . . ample sump in base for coolant . . . 2″ diameter high speed twist drill capacity in SAE 1035 steel . . . saddle feed through 3¼″ diameter cylinder . . . geared head mounted on saddle . . . 13″ width of hardened steel ways, 16″ length of travel.

The machine is illustrated with 30″ diameter standard automatic indexing table. This machine can also be supplied with hand operated index tables, or non-indexing adjustable height table.

For more information write for Baker circular number 69216.

For Versatility . . . BAKER Mobile Power Unit . . . Separate variable delivery mobile pump-sump unit mounted to rear of machine and illustrated above, provides hydraulic feeding power. The unit is mounted on casters and is connected to the machine by two self-sealing couplings designed to permit a fast exchange of hydraulic power units without influx of air into the hydraulic system. Units may be switched with negligible loss of production time.

BAKER BROTHERS, INC., Toledo, Ohio

DRILLING, TAPPING, KEYSEATING and CONTOUR GRINDING MACHINES

Unprecedented PRODUCTION PEAKS

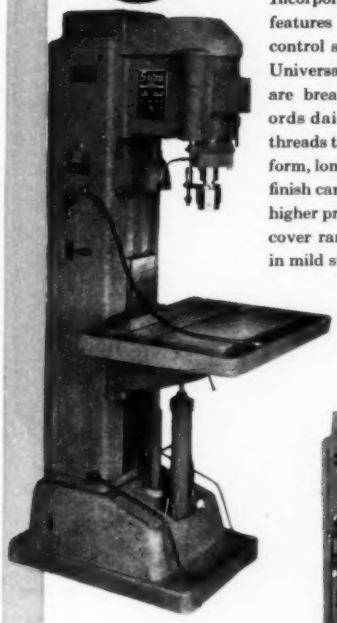
SNOW

FULL UNIVERSAL

DRILLING, TAPPING & THREADING MACHINES

Air-operated, Electrically Controlled

THREADER



SNOW THREADING MACHINE — Incorporating all the advanced features of air and electrical control sensitivity, Snow Full Universal Threading machines are breaking production records daily. Highly accurate threads true to lead and thread form, long chaser life and clean finish can be obtained at much higher production rates. 2 sizes cover range from #3 to 1 inch in mild steel.

TAPPER

DRILLER

SNOW FULL UNIVERSAL TAPPING MACHINE—4 sizes cover range from #0 to ¾ inch in mild steel.

SNOW FULL UNIVERSAL DRILLING MACHINE—2 sizes range from #60 to ¾ inch in mild steel.

In tomorrow's rugged profit competition only the best designed, highest producing machine tools can win. Snow machines, minimizing operator skill and effort are cutting costs of small parts in thousands of plants. They provide every conceivable method of control and permit quick set-up with any type of hand feed or automatic holding fixture. Extremely sensitive in feed, and accurate in depth of stroke. Production records previously unheard of are being reported.

Snow

HIGH PRODUCTION DRILLING TAPPING THREADING, NUT TAPPING, 2 SPINDLE, HORIZONTAL MACHINES, DRILL PRESS TAP HEADS, JIGS AND FIXTURES

SNOW MANUFACTURING COMPANY

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(Chicago Suburb)

Submit sample parts and blue prints for quotation, production estimates and tooling data.

BOOST Your "Batting Average" IN PRODUCTION AND PRECISION

With Kent-Owens Milling Machines in your production line-up . . . you'll turn out *more work* . . . with *greater accuracy* . . . and *lower costs!*

Shop men like the "feel" of these machines. Designed for rapid, easy set-up and operation. They've "plenty on the ball" in practical features, too! Efficient . . . rugged . . . dependable—assuring steady output without costly down-time.

In the Kent-Owens Standard line are a wide range of hydraulic and hand operated machines. Let a Kent-Owens engineer recommend machines and tooling best suited to your requirements. Write for details.
Kent-Owens Machine Co. Toledo, Ohio.

Call on KENT-OWENS *for Milling Machines*

No. 2-20 Milling Machine
Table, 42" x 12"
Table travel, 20"

KENT-OWENS REPRESENTATIVES

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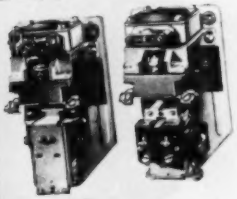
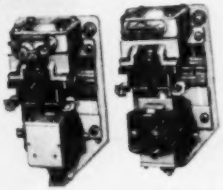
PNEUMATIC TIMERS FOR EVERY JOB A.C. or D.C.

for timing motor acceleration, machine sequences, process industry operations, etc. With wide variety of A.C. and D. C. timers, you can select exactly the right one for any given job.



above, left
A. C. Time delay after de-energization. Micrometer dial.

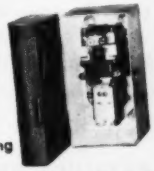
above, right
A. C. Time delay after energization. Electrical interlock.



above, left
D. C. Time delay after energization. Micrometer dial.

above, right
D. C. Time delay after de-energization. Electrical interlock.

Flush mounting plate



General purpose enclosure

THESE PROVEN ADVANTAGES OF A.C. DESIGN NOW FEATURED IN NEW D.C. TIMERS

ACCURATE—less than 10% variation, plus or minus, from mean timing period. Unaffected by normal changes in voltage and ambient temperature.

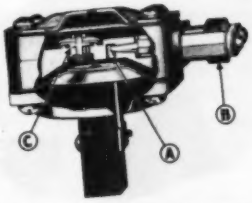
WIDE RANGE—timing period adjustable, 0.2 seconds to 3 minutes.

EASY TIMING ADJUSTMENT—quick fingertip setting of knurled knob or micrometer dial.

SNAP ACTION CONTACTS—normally open and normally closed in self-contained, arc-resistant melamine case—rated for A.C. or D.C. control circuits.

ELECTRICAL INTERLOCKS—operated by the magnet which actuates the timing mechanism—frequently eliminates need for additional switching relays.

THIS BASIC PNEUMATIC TIMER UNIT FEATURED IN ALL THESE TIMERS



How It Works: *Simple operating principle is based on the interval required to transfer a small volume of filtered air from upper to lower chamber through a regulated orifice (A). Rotation of knurled knob (B) gives wide range of adjustment. Air returns through valve (C) for instantaneous reset.*

Write **for Bulletin 9050. Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.**

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4" diameter

3/8" diameter

BIG or LITTLE

They offer high strength-weight ratio (axial and torsional)

It will pay you to get the *full story* on Apex Heavy Duty Industrial Universal Joints, made in sizes from 3/8" to 4" diameters. In addition to high strength-weight ratio their unique structural design assures low deflection rate, low wear, superior fatigue resistance and overload capacity and long life.

But that is not all: Apex Joints are sealed hermetically with flexible covers that keep lubricant *in* and keep trouble *out* and permit the joints to be used in corrosive or abrasive laden atmospheres or liquids, at extremes of temperatures.

Catalog No. 103-A gives complete information.

CATALOGS WILL BE SENT ONLY UPON REQUESTS WRITTEN ON COMPANY LETTERHEADS

APEX

Universal Joints

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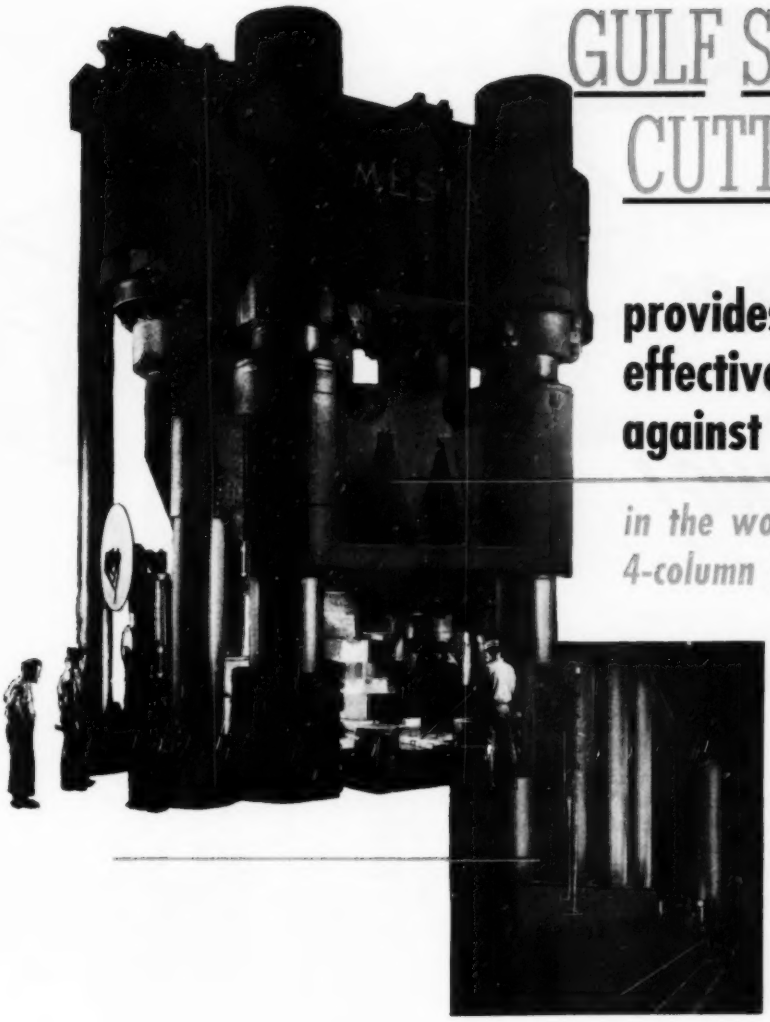
Safety Friction Tapping Chucks • Quick Change and Positive Drive Drill Chucks • Vertical Float Tapping Chucks • Parallel Floating Tool Holders • Power Bits for Phillips, Slotted Head, Frearson and Clutch Head Screws • Hand Drivers for Phillips and Clutch Head Screws • Aircraft and Industrial Universal Joints • Sockets and Universal Joint Socket Wrenches

GULF SOLUBLE CUTTING OIL

provides effective protection against rust

in the world's largest 4-column forging press



The four accumulator "bottles" in the foreground store up the high-pressure water required to operate this 18,000-ton die forging press. The surge tank in the background holds low-pressure water, acts as a sump for the pumps. This hydraulic system contains 19,000 gals. of water mixed with Gulf Soluble Cutting Oil, a stable emulsion which protects the entire system from rust.

Gulf Soluble Cutting Oil has excellent rust preventive properties—one important reason why it was selected for this huge press. Its protective film prevents contact of the corrosive elements, water and oxygen, with the metallic surfaces of the hydraulic system—helps insure freedom from operating troubles. Ordinary soluble oils do not provide equal protection against corrosion.

Gulf Soluble Cutting Oil emulsifies readily with water, forms a stable emulsion, and is non-foaming.

Gulf Soluble Cutting Oil is not only ideal for hydraulic systems but is equally effective as a cutting fluid on the machining jobs for which it is recommended. For further information on this quality product—and for one of Gulf's practical slide-rule-type calculators, which will help you maintain desired soluble oil concentrations—send the coupon below.

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ENGINEERED BY ELMES
Good Hydraulic Production Equipment Since 1851

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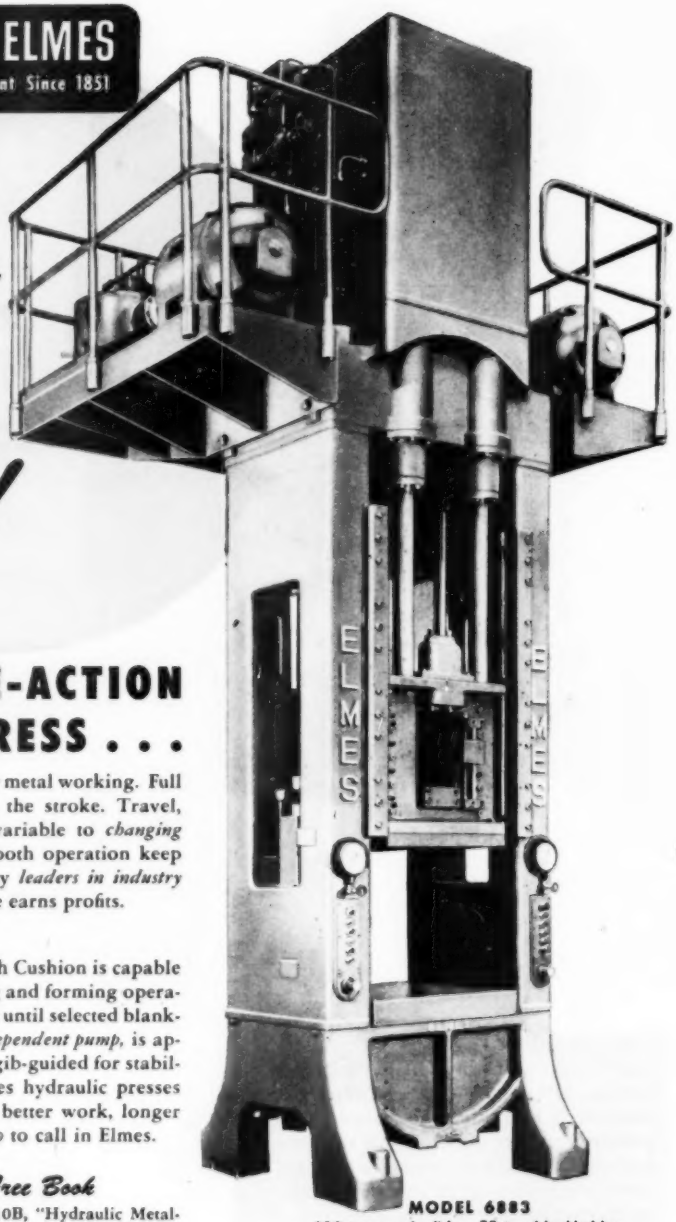

ELMES DOUBLE-ACTION HYDRAULIC PRESS . . .

Elmes hydraulic presses are *ideal* for metal working. Full power is exerted at any point in the stroke. Travel, speed, and pressure are quickly variable to *changing needs.* Simplified controls and smooth operation keep rejects remarkably low. That's why *leaders in industry* are Elmes users. Elmes performance earns profits.

VERSATILITY YOU'LL LIKE

The Elmes Double-Action Press with Cushion is capable of virtually *any* sheet metal drawing and forming operation. Punch cannot travel into work until selected blankholder pressure, *sustained by an independent pump,* is applied. Cushion, when furnished, is gib-guided for stability against eccentric loading. Elmes hydraulic presses bring you *every modern feature* for better work, longer runs, lower costs. It will pay *you too* to call in Elmes.

Ask for This Free Book

New Bulletin No. 1010B, "Hydraulic Metal-Working Presses," covers single-action, double-action, and triple-action presses; standard designs; special applications; automatic feeds. Your Elmes Distributor can supply you, or request direct—on your business letterhead, please.

MODEL 6883
100-ton punch slide. 50-ton blankholder. 12" draw and liftout. Cushion optional.

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...a better (!) cutting fluid for only 7 cents a gallon!

Yes, we said 7 cents! You supply the water, we'll furnish the cutting base. Mix it with 15 to 30 parts of H_2O, and you'll have a cutting fluid that will handle just about every machining need you can imagine.

It's ANTISEP ALL-PURPOSE BASE—the answer to today's demand for lower-cost machining. It's concentrated . . . fortified by high sulphur content for anti-welding properties, by fatty content for good wetting power, by high film strength additives that give it "guts".

Investigate ANTISEP All-Purpose Base from every angle—greater production, cleaner machines, satisfied operators, finer finish, longer tool life—and you'll see why so many shops the nation over are switching to this new concept in cutting fluid economy.

The whole story is told simply in a brief folder we'd be glad to send you. But you will be most convinced by a trial; ask the Houghton Man who calls on you, or write E. F. HOUGHTON & CO., Philadelphia 33, Pa.

HOUGHTON'S ANTISEP ALL-PURPOSE BASE

Gives a Perfect Fit for the Hard to Fit

The quickly, easily adjustable bridge of the AO 3039 is the protective answer for workers who find it difficult to secure a comfortable fit. The bridge permits every adjustment necessary — including self-adjusting of nose pad. Flange on eyewire provides a snug fit to bar flying particles from the nose side of eyes. Temples are insulated, heat resistant and perspiration proof. Metal side shields come with the goggle and are amply ventilated, non-corroding and easily cleaned.

The AO 3039 offers positive protection against particles striking from both front and sides. It is available with Super Armorplate or 6 Curve Super Armorplate *clear* lenses where only impact protection is required — and with *Calobar* lenses when operations also involve danger from glare, heat, ultra-violet and infra-red radiations.

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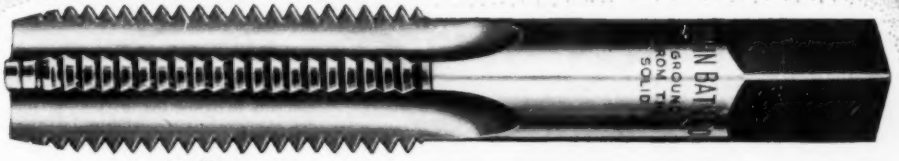
THEY MAY LOOK ALIKE

. . . but there's a difference!

JOHN BATH CO. INC. WORCESTER, MASS.

Both cigars may look alike to the unobservant eye, but one is made of the finest imported Havana tobacco while the other is a far inferior grade. Actual proof is in the smoking . . . immediate comparison shows a vast difference in quality and value.



THERE IS A DIFFERENCE IN TAPS, TOO!

All taps may look alike at first glance but the superior quality of BATH taps is proved by their efficient performance. Ground from the solid AFTER hardening, BATH taps have a uniform thread structure that is strong and accurate.

Today, with production costs so important, more plants are specifying quality BATH taps for greater speed on the job . . . for more holes per tap and for longer runs between sharpenings.

Regular stock types and sizes are available — or if you need taps of a special size or for working different materials, you'll find BATH representatives highly resourceful and BATH engineers widely experienced in unusual threading problems. Write, giving complete details . . . we'll be glad to tell you how to get the lowest cost per tapped hole.

INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED

22 Grafton St., Worcester, Mass.

A. O. Smith Builds ELECTRIC MOTORS

SMITHway Electric Motors Now Power Hundreds of Products, Including the

ATLAS FLOOR MACHINE

To electric motors, A. O. Smith is now devoting the same high standards of research and engineering which have distinguished the products of this firm for seventy-five years.

SMITHway Electric Motors are designed and built to bring to each application the maximum in compactness . . . safety . . . convenience . . . and trouble-free service.

For special applications, SMITHway Electric Motors are built to exact design specifications, both electrical and mechanical, to meet specific product demands.

For all standard applications, SMITHway Electric Motors are built in both fractional and integral horsepower ratings: single-phase, 1/10 to 7½ hp.; polyphase, 1/10 to 125 hp.

ATLAS FLOOR MACHINE, product of Atlas Floor Surfacing Machinery Corp., New York City, incorporates a SMITHway Electric Motor specially designed for the job. To retain the designer's requirements for good appearance, capacitors and starting mechanism are concealed under the top cover, with a vertical starting-to-running-switch mechanism. The entire machine recently passed rigid United States Navy tests.

SMITHway ELECTRIC MOTOR used in the Atlas Floor Machine is shown in operating position and, upside down, to expose gear and breather cap. To reduce over-all height, top end bell is concave, and necessary polishing weight is provided. Cast-in terminal compartment included for 3 prong terminals. The motor has high torque, and is built for continuous-duty operation. It exceeds the machine designer's required electrical performance.

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44 pages . . . six chapters of practical facts. Here is condensed information to give industrial executives a working knowledge of oil-operated or oil-controlled plant equipment.

Efficient, economical service from hydraulic mechanisms depends very largely upon the liquid which controls and drives them. This book tells the *how* and *why* of intelligent operation and maintenance.

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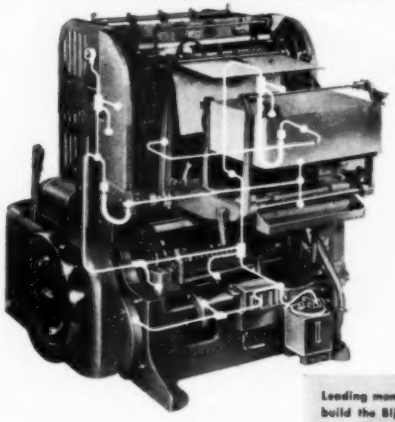
Improved Model V-50 Vertical Press



...when you provide automatic "trouble-free" lubrication for user satisfaction.

Your machines are your best salesmen. If your machine sells itself in terms of high productive output and low maintenance cost, it paves the way for future sales of more machines.

One way of helping your machine give peak performance is to equip it with a Bijur system of automatic "metered" lubrication, eliminating the erratic human element from the oiling routine.

This reduces bearing wear to a minimum by *automatically* maintaining the correct oil-film at each individual bearing. Maintenance costs are thereby cut and effective machine life is lengthened.

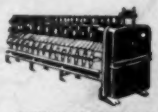
Timely Oiling. As a Bijur-lubricated machine oils itself while running, downtime for oiling is eliminated. This results in more time for production and a consequent higher daily output per machine.

"Built-in" Lubrication. To turn out a clean-lined machine, build the Bijur system in *at time of manufacture.* Your protected Bijur-oiled bearings will run more smoothly over a longer period of time.

It will pay you to talk over the lubrication of that new machine with the Bijur engineer, or write for "The Travels of Modern Lubrication." This quarterly bulletin shows how leading manufacturers solve their lubrication problems by building "metered" lubrication into their machines.

Leading manufacturers who build the Bijur system into their machines.

MACHINE TOOLS
Cincinnati "Milling Machine"



TEXTILE MACHINERY
Saco-Lowell "Spinning Frame"

PUNCH PRESSES
V & O "Notching Press"

BUSINESS MACHINES
IBM "Reproducer"

FOOD MACHINERY
Crown Cork & Seal
"Syruper-Filler-Crowner"

Like these manufacturers, you too can "be sure with Bijur"

BIJUR

LUBRICATING CORPORATION

LONG ISLAND CITY 1 NEW YORK

Single-purpose machines cut costs

Special automatic drilling and tapping machines save money with high production

Dear Sir:

In an hour one Kingsbury with one operator performs 5,184 operations on lock cylinders. In one hour the other Kingsbury with one operator performs 5,824 operations on gear housings. (Both at 80% efficiency.)

ACCURATE, UNIFORM PARTS

All operations are complete in one chucking. Bushings guide the drills. Fixtures are duplicates, jig bored to minimum toolroom tolerances. Spindles are located to exact indicator readings and run in precision ball bearings. Automatic cycles make every part uniform.

UNIT COSTS IN PENNIES

Man and machine cost 8/10c for all 9 operations on each lock cylinder. They cost 1-9/10c for all 16 operations on each gear housing. These costs are based on 1) the national average wage rate, 2) 80% efficiency and 3) paying off the full cost of the machine and tooling in the first 6000 hours of operation. (No power or overhead.)

SHORT PAY-OFF PERIOD

Each machine will run many times longer than 6000 hours. We used that basis because most firms want their money back in 1 to 3 years. If the pay-off period were longer, they would try other methods.

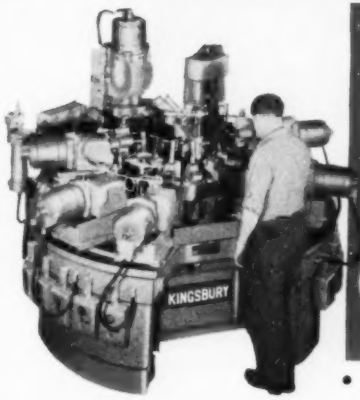
CHECK COSTS FROM PROPOSALS

We prepare many proposals on tooled machines so that high production plants can compare their costs. Many never result in orders, of course, a fact that our general manager accepts philosophically. "At least they are fun to work out," he says, pausing for a reaction.

So don't hesitate to ask for a proposal. Send a print to our Mr. L. A. Carll and tell him the operations and hourly output you need. And ask him for free bulletins that show 40 setups.

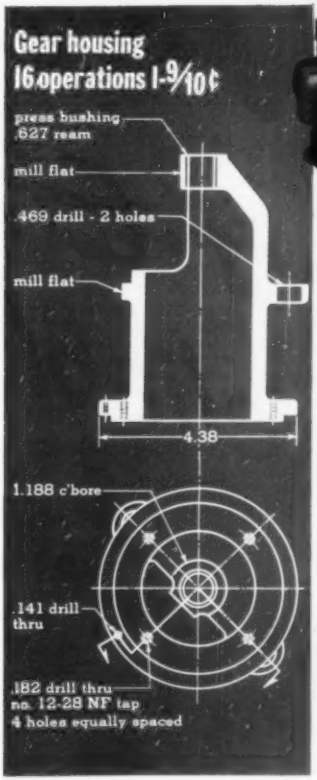
Sincerely,

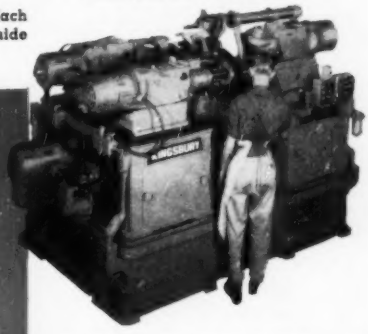
Kingsbury Machine Tool Corp.
20 Laurel St., Keene, N. H.



720 PARTS AN HOUR GROSS. This horizontal indexing Kingsbury drills the 6 pin holes, mills the T-slot and spots the dubb hole in one chucking.

- Six units drill the pin holes. Each fixture has a bushing plate to guide the drills.
- Two units mill the T-slot — one the throat and one the head space.
- An underneath unit spots the dubb hole. A bushing guides the drill.
- A hand plunger ejects each finished part from its fixture.





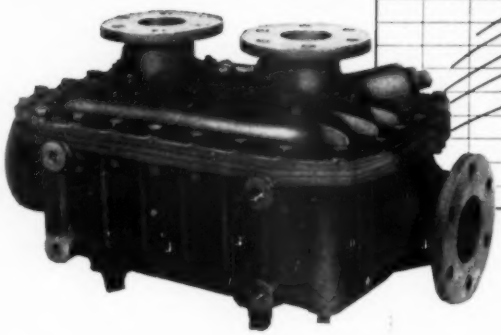
455 PARTS AN HOUR GROSS. This vertical indexing Kingsbury enables 8 automatic units to operate on opposite faces of the part in the same chucking.

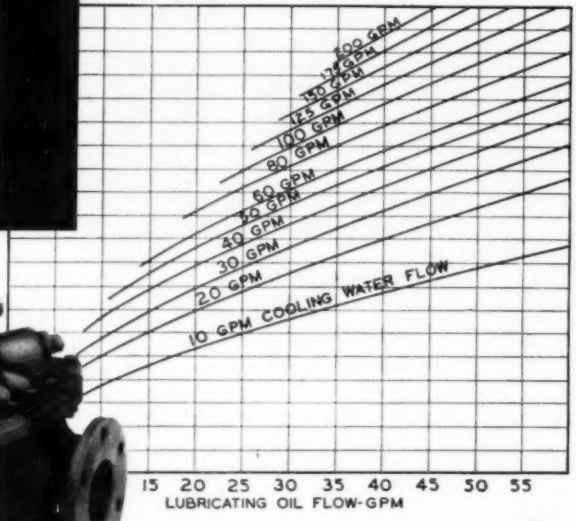
- An air-operated mechanism with chute feed inserts the bushing at the first working station on the right. A standard unit reams the bushing to size at the fifth station.
- The 1.188 counterbore is piloted. Its spindle has a 7-inch stroke to reach deep inside the part.
- Standard drilling units with standard milling heads mill the flats.
- Standard units with 2- or 4-spindle auxiliary heads operate on the two .469 and four tapped holes.

KINGSBURY

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

HARRISON OIL COOLERS





Compact. Efficient Reliable

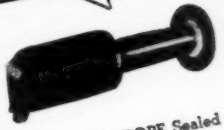
BUILT TO DO A JOB AND DO IT WELL

HARRISON

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, N. Y.

Put These POPE PRECISION SPINDLES To Profitable Use

Your grinders and other machine tools will do more and better work when they are equipped with these skilfully designed, precision made, *sealed package* Spindles.



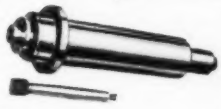
P-327—This POPE Sealed Motorized Spindle is recommended for all makes of 6" x 18" surface grinders. It has sealed-in 1 HP motor and sealed lubrication, SKF super-precision, double row roller bearings. It assures finer finishes and greater production.

P-2514—This POPE Motorized Spindle with sealed lubrication is recommended for a broad range of grinding, milling and boring applications. It runs in any position from horizontal to vertical. It comes in sizes from ¾ to 20 HP, 900 to 3600 RPM.

P-1—This POPE Belt-driven, Cartridge Type Surface Grinder Spindle with sealed-in lubrication fits standard grinders. It operates at speeds up to 6000 RPM. It gives long, dependable service.

P-2632—This POPE Direct Motorized Cartridge Type Spindle with 1 HP, 3450 RPM totally enclosed motor is equipped with mounting bracket with provision for 3" of precise endwise adjustment.

P-274—This POPE Double-Ended Tool and Cutter Grinder Spindle with sealed lubrication employs twin belt pulley center drive at speeds up to 6000 RPM. Fits standard grinders.



P-3521—This POPE Internal Grinding Spindle is adapted to mount Jarno taper interchangeable extension arbors to cover a broad range of service. The 1" series shown on page 3 of Data Sheet No. 7 will fit this spindle.

For complete specifications and estimates on any or all of these Spindles get in touch with

No. 60

POPE

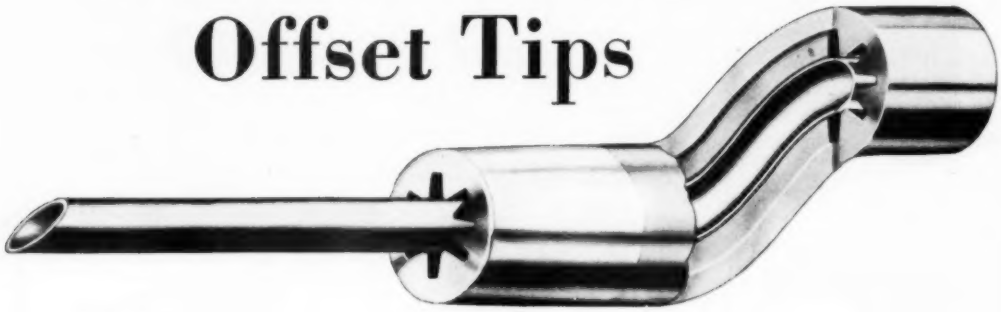
POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

MALLORY Fluted *and* Bent Offset Tips



The Ultimate in Offset Tips – *A Mallory Exclusive!*

First, Mallory made news with the bent offset tip that carried the water to the welding face!

Then Mallory perfected the Mallory Fluted Tip† — a 70% increase in cooling area, faster heat dissipation, reduced mushrooming, required less frequent dressing—all at no increase in price!

Now Mallory Creative Research has successfully combined these two great tip features into one. Now *you* can have the ultimate in *your* welders: fluted water holes in bent offset welding tips . . . and you can have them through Mallory and Mallory alone!

Making news in the welding field is an old story at Mallory. Again and again, Mallory has come through with ideas, practical ideas—because Mallory has underwritten more extensive research than any other maker of resistance welding alloys, tips, holders and dies.

Which means if you want the best *first*, check with Mallory!

In Canada, made and sold by Johnson, Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Resistance Welding Tips, Holders, Dies, Rod and Bars, Castings, Forgings

SERVING INDUSTRY WITH

Capacitors — Rectifiers
Contacts — Switches
Controls — Vibrators
Power Supplies
Resistance Welding Materials

†Patent Applied For

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

This 12,500% increase *sounds fantastic!*

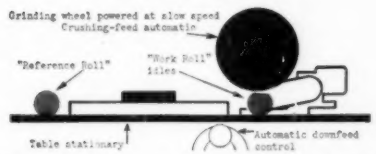
But True! One of the major drawbacks to crush form grinding precision flat form contours has been the inability to produce on a practical production basis. This obstacle has been eliminated in two ways by the new Thompson Truforming Process.

First: Truform Grinders are engineered and built as a single unit, eliminating the failures of make-shift crushing arrangements and attachments.

Second: TWO CRUSHING ROLLS ARE USED. This is a major advancement, because it greatly extends crushing roll life and makes possible, for the first time, quantity production without constantly disturbing the set-up to re-process the crushing roll.

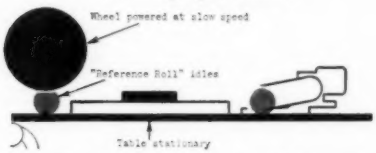
How two rolls operate in the Truforming Process is briefly illustrated and described below. The normal crushing or truing position is shown first.

Normal Crushing Position
Also Truing or Dressing



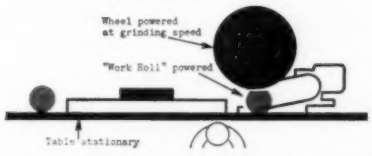
This is the position for the initial crushing of the wheel—and for subsequent truing or dressings when production grinding. On an eight pitch modified buttress thread form, 125 dressings were provided by the "work roll" before losing form.

Touching-up Position



When the "work roll" loses form the table is moved to bring the grinding wheel over the "reference roll" for touching up, as shown above.

Re-processing Position



Because both rolls are table mounted, are in perfect alignment, and can be brought in the same relation to the grinding wheel, the original degree of accuracy can be quickly transferred from the "reference roll" back into the grinding wheel . . . and then ground back into the "work roll" as shown above.

The machine is then ready for production grinding again without disturbing the set-up or removing anything from the machine. In this way the "work roll" can be re-processed whenever it loses form and can be used for hundreds of additional dressings, or until it is worn out. Duplicate crushing rolls can be ground in the same way on all Thompson Truform Grinders.

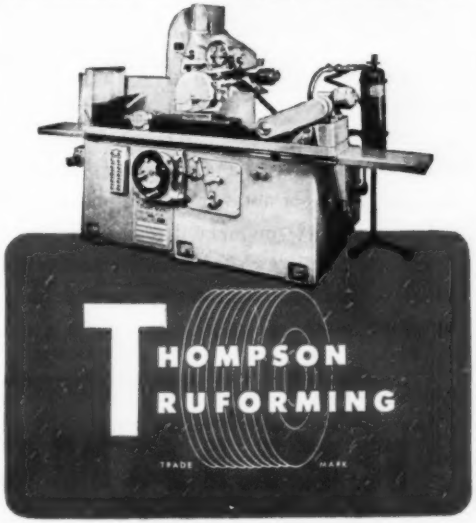
$125 \times 125 = 15{,}625$

Dressings per master roll before Truforming × Added reprocessings per roll = Dressings per roll with Truforming on a thread form contour

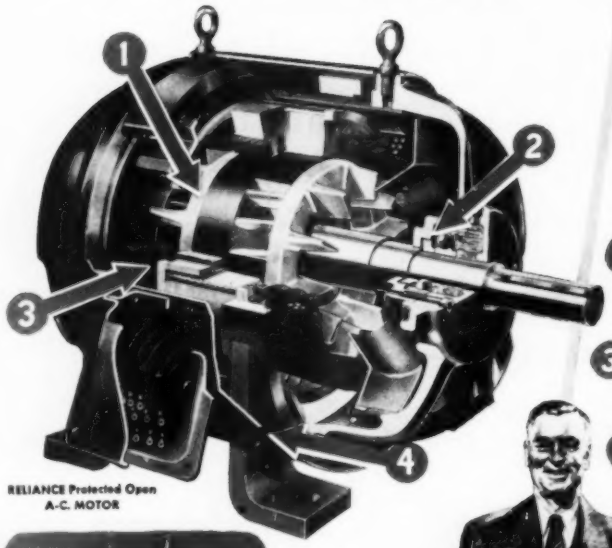
What this means in savings is illustrated by the following example, involving a modified buttress thread form with an eight pitch form. Where two rolls are used in the Thompson Truform Process, it was possible to get *over 15,625 dressings* from the "work roll" before it was worn out. This meant an increase in continuous production (without changing or disturbing set-up) of 12,500%.

WRITE FOR NEW CATALOG
Address Dept. 10

The Thompson Grinder Company • Springfield, Ohio



WHO SAYS "All Motors are Pretty Much Alike?"



RELIANCE Protected Open A-C. MOTOR

These Four Features *Alone* make RELIANCE the motor for you!

1. **Dynamic Balancing — Precision Fits** — Every motor is dynamically balanced by skilled technicians using latest electronic-principle equipment. Machining of parts to exacting tolerances guarantees precision fits throughout. Result: a smoother-running, longer-lasting motor!
2. **No Lubrication Worries** — Precision Bearing Mounting, with double-shielded ball bearings, assures longer bearing life under all normal conditions, whether overgreased, undergreased or not greased at all. *"You can't grease 'em wrong!"*
3. **Roll-X Insulation** furnishes a new high in the protection of stator windings. Selected materials, exclusive methods and new continuous-sequence applications make this the *unfailing* insulation!
4. **Steel for Strength** — Steel construction, with electrically welded joints, combines maximum strength with minimum weight.

RELIANCE *Precision-Built* MOTORS

. . . are made *better* to deliver DEPENDABLE POWER — LONGER!

Reliance has a way of building motors that must be seen to be fully appreciated. Any time we can take a motor user through the modern plants where Reliance *Precision-Built* Motors are made, we can be reasonably sure of another good Reliance customer. We would be delighted to have you make this visit. But if it isn't practical, call in your nearest Reliance representative and *see* the convincing facts he can show you on the precision methods that produce these truly superior motors.

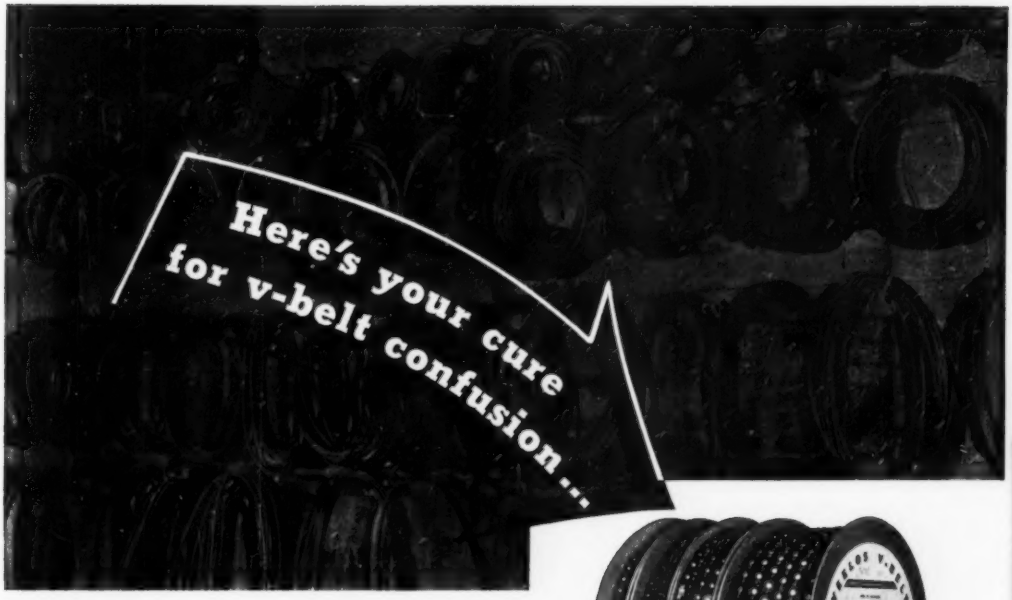
HOW TO SELECT THE RIGHT MOTOR

Here's a book which digests all the information you should have in selecting the motor that's just right for any job. New torque and current standards recently adopted by the National Electrical Manufacturers Association for A-c. motors are tabulated and explained. And these are further supplemented by more detailed performance data on Reliance *Precision-Built* Motors. Write today for this important new Motor Data Bulletin, B-2101.

Sales Representatives in Principal Cities

RELIANCE ELECTRIC AND ENGINEERING CO.

"Motor-Drive Is More Than Power" • 1075 Ivanhoe Road, Cleveland 10, Ohio



4 reels of VEELOS can replace 316 sizes of endless v-belts

HAS your v-belt inventory grown too large, too costly and too complicated by too many sizes of endless v-belts? No matter what size your inventory, Veelos can cut it—drastically!

Let's assume that you use O, A, B and C widths. With only four reels of Veelos you can make up more than 316 sizes of endless v-belts. If you use only A and B sizes, your entire v-belt inventory will be complete with just two reels. Any length belt is quickly uncoupled from a reel, made endless and installed.

Ease and speed of installing Veelos lowers machine downtime. On drives with outboard bearings, it is installed without moving the motor or dismantling the machine.

FREE VEELOS CATALOG shows how Veelos can bring many distinct v-belt advantages to your plant. See page after page of illustrations of Veelos at work in industry after industry. Full engineering data is given. Write for your free copy today.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.

VEELOS
THE LINK
V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

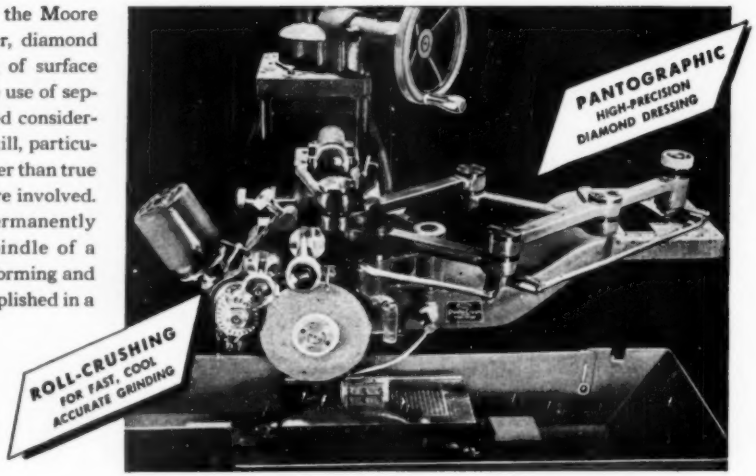
Made in all standard sizes, fits all standard grooves. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 300 distributors throughout the country. Veelos is known as VEELINK outside the United States.

Now you can combine roll-crushing and diamond dressing in a single wheel dresser to speed form grinding

Before the development of the Moore Panto-Crush Wheel Dresser, diamond dressing and crush-forming of surface grinder wheels called for the use of separate devices. These required considerable set-up and operating skill, particularly where odd contours other than true radii and straight surfaces are involved.

Now with the Moore, permanently mounted on the wheel spindle of a surface grinder, both crush-forming and diamond-dressing are accomplished in a single mechanism.

Here's how this 2-in-1 machine does it:



1. Combines Pantograph, working directly from template, and *Roll-Crushing* in one device, accurately related to spindle.

2. Switches from one method to the other without disturbing workpiece setting or location of either trueing device.

3. No setting up of complex attachments each time wheel is dressed ... no raising of wheel spindle from work to dress, yet wheel spindle may be raised or lowered without losing relation of wheel form to dressing device ... crusher method saves diamond costs.

4. Assures highest roll-crushing accuracy and economy. Crusher roll is *ground* and *used* on same spindle, without disturbing position ... no expensive machine required to grind crusher roll ... no worry about hardening distortion, because roll is ground *in place* from the solid directly from template.

5. Takes Skill out of job, yet adds advantage of crush dressing for heavy cuts without heating work, and ultra-precision diamond dressing.

6. Device need not be removed to use machine as conventional surface grinder.

Both MACHINE DESIGN and MACHINERY magazines devoted considerable editorial space to technical discussions of the value of this ingenious new mechanism. We'll be glad to send you reprints and a descriptive catalogue on Panto-Crush.

MOORE SPECIAL TOOL CO., Inc.
738 UNION AVENUE, BRIDGEPORT 7, CONN.

HAVE YOU BOUGHT YOUR COPY OF "PRECISION HOLE LOCATION"?

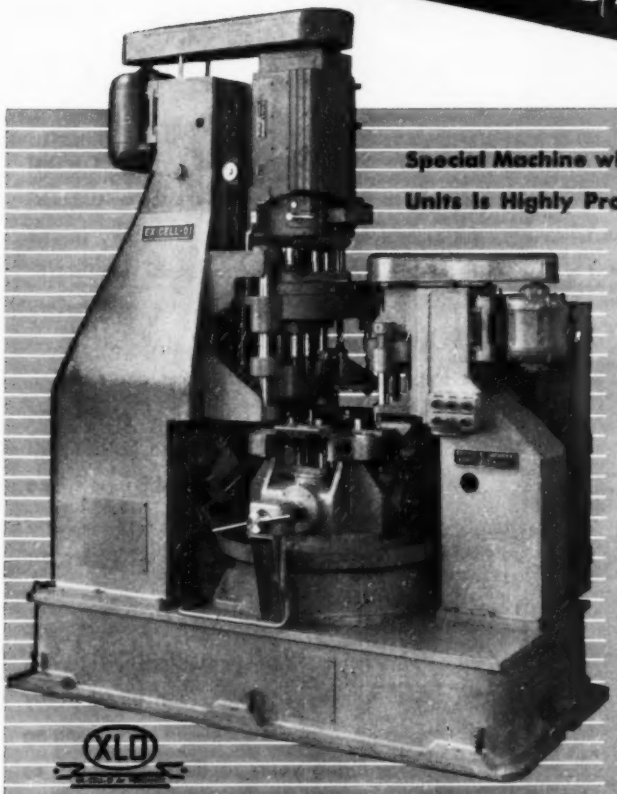
Over 5,000 copies of this valuable book on toolmaking practices have been sold to date. Available at special price of $3 in U. S. A.; $3.50 outside U. S. A. 448 pages, over 400 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Send check or money order to Moore Special Tool Co., Inc., Bridgeport 7, Conn.

Add a MOORE to YOUR TOOLROOM

JIG BORERS · JIG GRINDERS · PANTO-CRUSH WHEEL DRESSERS
DIE FLIPPERS · COMPLETE LINE OF HOLE LOCATION ACCESSORIES

WANT TO CUT COSTS?

See EX-CELL-O



Special Machine with Ex-Cell-O "Package" Power Units Is Highly Productive . . . Low in First Cost!

Ex-Cell-O machines for combined operations save floor space, save handling, save man-hours. When Ex-Cell-O's standard hydraulic power units are used for feeding and rotating the cutting tools, the first cost is low. The Ex-Cell-O special machine shown to the left drills nine holes, reams one hole, and taps three holes in cast iron water pump body at a net rate of two parts per minute! If your production involves operations like this, get in touch with Ex-Cell-O in Detroit today!

40-7

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

This better way of Contour Finishing

. . . another case of BEHR-MANNING PIONEERING *with* METALITE® BELTS

Long belts for cooler cutting. This set-up was devised by Behr-Manning Application Engineers.

Grinding an inside curve is easy with a contact wheel formed to do it.

The concave surface on this contact wheel fits the job perfectly.

A flexible abrasive belt and a contact wheel formed to fit the work — this was the successful answer by Behr-Manning engineers to the growing demand for higher production, better finish, and greater economies in a wide variety of contour grinding jobs.

The wrench finishing method illustrated is a case in point. Faster, because of the sharper, factory-coated belt. Better finish, because of the grit uniformity of the METALITE belt, and the uniform pressure of the formed contact wheel. Greater economies because operators produce more pieces per hour — and because you save the cost of replacing set-up wheels.

Behr-Manning Application Engineers, in laboratories fully equipped and strategically located, are constantly solving new grinding problems. Bring yours to them. Write us to put you in touch.

BEHR-MANNING

BEHR-MANNING • TROY, N.Y.

NORTON *abrasives*

ALSO QUALITY OILSTONES FOR INDUSTRIAL NEEDS

Hanna Rapid Riveters

...RIVETING AT GREATER SPEED BECAUSE THEY ARE TOOLED TO DO YOUR JOB!

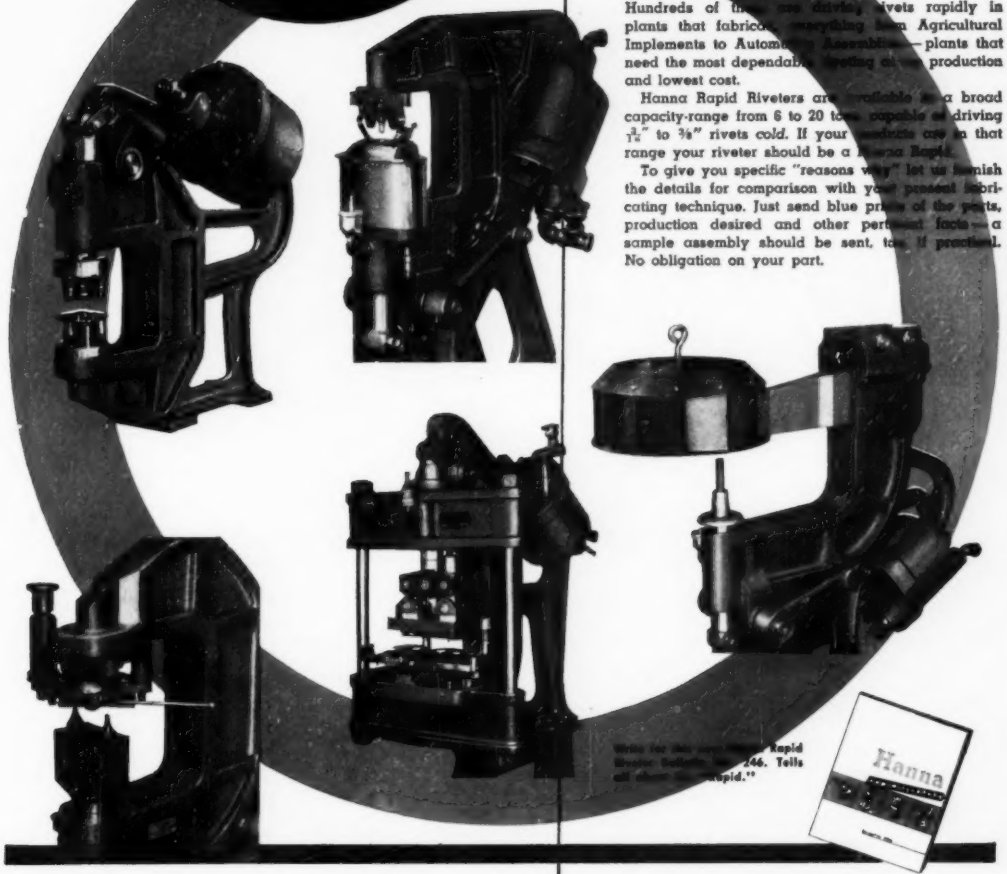
They are called "Rapid Riveters" for two good reasons:

- their speed in setting a tight rivet in one stroke . . . and
- their adaptability to simple tooling that make them practicable even for *your special job.*

Hundreds of these are driving rivets rapidly in plants that fabricate everything from Agricultural Implements to Automotive Assemblies — plants that need the most dependable riveting at low production and lowest cost.

Hanna Rapid Riveters are available in a broad capacity-range from 6 to 20 tons, capable of driving $\frac{3}{16}$" to $\frac{5}{8}$" rivets cold. If your needs are in that range your riveter should be a Hanna Rapid.

To give you specific "reasons why" let us furnish the details for comparison with your present fabricating technique. Just send blue prints of the parts, production desired and other pertinent facts — a sample assembly should be sent, too, if practical. No obligation on your part.



Write for this new catalog on Hanna Rapid Riveters. Bulletin 246. Tells all about these "Rapid Rapid."

Hanna Engineering Works

1765 Elston Avenue, Chicago 22, Illinois

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

Farrel can supply you with *precision-generated* internal gears, with either spur or single helical teeth, in any size up to approximately 16 feet in diameter, 12-inch face, 1¼ DP.

The "blueprint" that makes these gears possible is the Farrel-Sykes gear generator. This machine generates internal gears with the same accuracy of tooth contour and tooth spacing that has made the continuous-tooth, herringbone *Gear with a Backbone* so well known throughout industry.

When you need smooth-operating, quiet and efficient internal gears, call Farrel. Full information, as well as engineering help, available on request.

FARREL-BIRMINGHAM COMPANY, INC.
344 VULCAN STREET, BUFFALO 7, N. Y.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Los Angeles, Tulsa, Houston

FARREL

Farrel-Birmingham

FB-528

FREE LITERATURE

New Catalogs, Booklets, Bulletins

MACHINES AND ATTACHMENTS

1 ATTACHMENTS AND ACCESSORIES—*South Bend Lathe Works, South Bend 21, Ind.* 28-page catalog 77-U presents practical attachments and accessories designed especially for South Bend lathes. Standard extras include such items as collet, chuck attachment, taper attachments, thread dial indicator, carriage stop, etc.

2 CUT-OFF MACHINES — *Buehler Ltd., Chicago, 3 Ill.* 4-page folder covers the AB cut-off machines for the metallurgical laboratory. The No. 1000 machine offers an inclosed design making possible a flood of water for cool cutting, and shielding the operator from water and abrasive fragments.

3 PRECISION CYLINDRICAL GRINDERS — *Landis Tool Co., Waynesboro, Pa.* 16-page booklet A-49, illustrates and describes the Landis 4-in. Type-H plain hydraulic cylindrical grinder. Included are 37 illustrations of the machine, its parts, grinding setups and extra attachments.

4 METAL STITCHERS—*Acme Steel Co., Chicago 8, Ill.* 6-page folder with extra data sheet gives information on the Acme-Shuebrook metal stitchers for attaching metal to metal or to asbestos, wood, plastic, canvas, rubber, and other materials, eliminating the use of rivets, screws, nails or spot-welding.

5 ROLL FORMING EQUIPMENT—*The Yoder Co., Cleveland 1, Ohio.* One 16-page booklet and seven smaller booklets cover the Yoder metalworking machinery for roll forming equipment, gang-slitters for coils, sheets, uncoilers, idle roll coil boxes, the Yoder power hand-saws, and the resistance weld pipe mill.

6 DRILL, TAP GRINDERS—*Gallmeyer & Livingston Co., Grand Rapids, Mich.* 32-page catalog covers construction features as well as illustrations and descriptions of the different Grand Rapids drill and tap grinders. Material regarding the care and use of twist drills are included.

7 FRICTION SAWS—*Kiley Bros. Engineering Works, Chicago 31, Ill.* 4-page bulletin 3400 describes the 4000 Series horizontal-stroke high-speed friction saws for production cutting. Machines are offered as alternate to the Standard No. 4, 4½, or 5 saws, with a choice of 75-, 125-, or 200-hp motors.

8 BENCH SAWS, FLOOR SAWS—*Atlas Press Co., Kalamazoo, Mich.* Two 2-page bulletins cover the Atlas 8- and 10-in. tilt arbor bench saws, and the Atlas 10-in. tilt arbor floor saws respectively. All models feature the quick-positioning rip fence with vernier controls to fine adjustment.

9 MILLING, CENTERING MACHINES—*Davis and Thompson Co., Milwaukee 14, Wis.* 4-page folder 170 presents the Davis and Thompson Rotomatic Milling and Centering Machines. The index-type machine can be operated at 300 fpm with carbide cutters.

10 ABRASIVE-BELT MACHINERY —*Standard Electrical Tool Co., 7489 W. Sixth St., Cincinnati 7, Ohio.* Bulletin 70 lists the company's bench and floor models with horizontal backstands, flexible horizontal-vertical backstands, individual wheelhead and various sizes of swing frames and 4-in. cylinder backstands, using from 4- to 20-in. pin contact wheels.

11 INVOLUTE SPLINES — *National Broach & Machine Co., Detroit 11, Mich.* 12-page booklet SP45-11 covers recommended series of splines developed by National Broach and Machine engineers. Series is developed to cover need for practical range of side-bearing splines of involute form, having root clearance on both the shaft and the hole.

12 PRESSES—*Sales Service Machine Tool Co., St. Paul, Minn.* 4-page bulletin covers the Press-Rite presses and provides information on presses ranging in capacity from 5 to 30 tons in six standard models. Presses are the open-back inclinable type.

13 SURFACE GRINDERS—*The Do-All Co., Des Plaines, Ill.* 8-page booklet contains specifications and photos of six models of hydraulic surface grinders for toolroom and production lines. Machines perform precision flat grinding, shoulder grinding and form grinding operations.

14 MECHANICAL FEED UNIT—*National Automatic Tool Co., Inc., Richmond, Ind.* 4-page folder 747 gives information on the A-42 electronic mechanical-feed unit. The self-contained unit accomplishes automatic work cycle such as rapid traverse forward, coarse feed forward, fine feed forward, dwell, rapid traverse reverse, and stop.

TOOLS AND ACCESSORIES

15 GAGES, GAGE INSTRUMENTS —*Dodd Co., Des Plaines, Ill.* 140-page bound book is the second edition. The book is divided into four parts and includes inspection instruments, questions and answers about gage problems, quality control and general information.

16 MOUNTED WHEELS, POINTS—*Simonds Abrasive Co., Philadelphia, Pa.* 8-page folder ESA-65 points out the versatility of mounted wheels and points for all-hand and precision work and for grinding in hard-to-reach places. Included is information on grains and grades, operating speeds and a section giving four rules for ordering the desired wheels and points.

17 *DIAMOND TOOLS — Super-Cut Inc., Chicago 41, Ill.* 12-page folder covers Zurium bonded diamond wheels. Sizes and specifications are given. Also offered is a four-page folder on Diamond Dressing Tools and one on diamond tools for surfaces, thread, internal, profile external, and radius gear grinders.

18 REVERSIBLE PLUG GAGES—*Pratt & Whitney, Div., Niles-Bement-Pond Co., West Hartford 1, Conn.* 4-page folder covers the go and no-go reversible plug gages, both the cylindrical and thread type. The reversible cylindrical plug gages are regularly furnished for checking the diameter of holes from 0.030 to 0.510 in.

19 HOLE PUNCHING UNIT—*Wales-Strippit Corp., North Tonawanda, N.Y.* 16-page catalog illustrates and describes the Wales Type CJ hole-punching unit designed to punch holes 1¼ in. in mild steel or 1 in. in 45-in.-thick mild steel.

20 GAGE BLOCKS AND FIXTURES —*The Webber Gage Co., Cleveland 11, Ohio.* 4-page folder tells how to apply gage-block accuracy direct to work. Gage blocks can be assembled to measure any height from 0.30 in. to 36.00 in. in steps of 0.0001 in. with an accuracy in 0.00001 in.

21 REVERSIBLE TUNGSTEN-CARBIDE GAGES—*Size Control Co., Chicago, Ill.* Catalog 49 gives information on the reversible plain and thread plug gages, centerless lapping machines and complete line of tungsten-carbide and Norbide gages.

22 SHEET-ALLOY WEIGHT CALCULATOR — *Dayton Rogers Mfg. Co., Minneapolis 7, Minn.* Strip weight calculator for figuring weight of sheet, strip, plate, bar, rod, tube, wire, angle, channel, I-beam, T-bar, Z-bar, hexagon, octagon, and round stock.

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cubator determines the over-all weight of various sheet and strip alloys, including steel. Constants are provided for aluminum, copper, bronze, lead, zinc, etc.

23 CYLINDERS—*Hanna Engineering Works, Chicago, Ill.* 20-page catalog 234 includes dimensional drawings, construction features and capacities on all standard sizes of Hanna low-pressure cylinders, and gives information on mounting-bracket cylinder cushions, etc., as well as cylinder-selection data.

24 RESISTOR AND CONTROLS—*Clarostat Mfg. Co. Inc., Dover, N.H.* The No. 49 Clarostat catalog presents a complete line of resistors, controls and resistance devices. Several new items have been added to the Clarostat line.

25 HYDRAULIC WEIGHING CELLS — *Baldwin Locomotive Works, Philadelphia 42, Pa.* 6-page folder 288 contains information on the Emery hydraulic cells for general industrial weighing and special laboratory testing equipment. Six standard models ranging in capacity from 10,000 to 100,000 lb. and special cells having load capacities from 40 lb to 2500 tons are described.

26 HONING MACHINES AND TOOLS — *Sunnen Products Co., St. Louis 10, Mo.* 4-page folder describes the Sunnen line of honing machines and tools. Included are the Model K vertical honing machine for production honing of cylinders, and the Model B-1 for toolroom use and short-run production honing of cylinders varying from ¼ to 4 in. in diameter.

27 DIESEL ENGINE PYROMETER —*The Bristol Co., Waterbury 91, Conn.* 12-page bulletin P-1239 covers the Bristol direct-reading pyrometers, suitable for use on all types of diesel engines. The approved Navy and commercial type pyrometers and thermocouples are described and illustrated with photographs and dimensioned drawings.

HEAT-TREATING AND WELDING

28 RESISTANCE HEATERS—*Ajax Electric Co., Milford, Mich.* 4-page folder describes resistance heaters that provide low operating cost (7 to 8 pounds per KWH at 2300 F) and proportionate economies for annealing and other low-temperature operations.

29 WELDING EQUIPMENT—*Smith's Welding Equipment Corp., Minneapolis 7, Minn.* 48-page catalog 149 covers the line of Smith's welding equipment. Torches and cutting assemblies, regulators, acetylene generators, regulator adapters and other parts offered.

30 HEAT-TREATING FURNACES—*Cooley Electric Mfg. Corp., Indianapolis, Ind.* 18-page folder covers the Cooley small electric heat-treating furnaces with controlling and accessory equipment.

31 HEAT-TREATING—*Sunbeam Standard Industrial Furnace Division, Sunbeam Corporation, Chicago 50, Ill.* 8-page folder 7340C describes the conveyorized harden, quench and draw installation at American Fort Pitt Spring Division of the H. K. Porter Co. The Bulletin explains how the double link conveyor bafflesl springs through the quenching oil.

PLANT SERVICE EQUIPMENT

32 ROLLER CHAIN—*Atlas Chain and Mfg. Co., Philadelphia 24, Pa.* 12-page booklet contains information and specifications on roller chain. Included are new features for safety, wear and maintenance as well as operating characteristics.

33 FILTERING EQUIPMENT—*Hanna-Cruse Corp., Lebanon, Ind.* A set of four, two-color booklets gives the story on the value of filtering oils and coolants used in metal-working operations such as cutting, grinding, boring, honing, quenching, etc.

34 AC MOTOR—*Reliance Electric and Engineering Co., Cleveland, Ohio.* 4-page bulletin C-130 covers the company's explosion-proof, corrosion-resistant ac motor. It is built to standards set by Underwriters Laboratories for operation in Class I, Group D, for locations where hazardous conditions are present.

35 MATERIAL FLOW EQUIPMENT —*The Rapids-Standard Co. Inc., Grand Rapids, Mich.* 36-page booklet entitled "Repistan Material Flow at Work" discusses principles of keeping goods in motion with a minimum of physical effort, and the application of these principles in various lines of industry.

36 GUSHER COOLANT PUMPS—*The Rudman Machinery Co., Cincinnati, Ohio.* 66-page booklet covers Gusher Coolant pumps. The booklet is divided into seven sections entitled Foreword; Immersed-Type, Motor-Driven Pumps; Pipe Connected-Type, Motor-Driven Pumps; Piston-Mounted External Discharge-Type Motor-Driven Pumps; and others.

37 AUTOMATIC pH CONTROL—*Leeds & Northrup Co., Philadelphia, Pa.* 20-page illustrated bulletin is entitled "For Effective Neutralization of Industrial Waste—Micromax Automatic pH Control." Described and pictured are the two available control systems, Micromax Electric and Micromax Pneumatic Controls.

38 FINISHING AND DEBURRING —*The Sturgis Products Co., Sturgis, Mich.* 16-page booklet describes the Reto Finish process of mechanical deburring and finishing. The operation eliminates manual operations requiring file scrapers, polishing and buffing wheels. It handles parts in bulk loads and requires no skilled labor.

PARTS AND MATERIALS

39 WIRE CLOTH — *Reynolds Wire Co., Dixon, Ill.* 40-page catalog lists the varied wire cloths available and gives specifications and illustrations. Definitions of wire-cloth terms are included.

40 CYLINDERS — *Lindberg Engineering Co., Chicago 13, Ill.* Two 12-page bulletins AC-1 and N50 respectively cover the Lindberg double-acting air cylinders and hydraulic cylinders. The various types and sizes are illustrated and specifications are included.

41 AC MOTORS — *Electric Machinery Co., Minneapolis 13, Minn.* 20-page EM Synchronizer No. 26 contains information on application of large synchronous and induction motors, and their controls in pulp and paper mills.

42 STAINLESS CHART — *Peter A. Frasse & Co., Inc., New York 13, N.Y.* Stainless mechanical property chart Sec.A 7, supplements the usual stainless property data. Chart shows typical mechanical properties, tensile yield, hardness, etc.

43 OAKITE 40TH ANNIVERSARY ISSUE—*Oakite Products, Inc., New York 6, N.Y.* 36-page booklet explains the services rendered by Oakite technical service representatives. Oakite Products. Representatives are trained in the latest technical developments and techniques of industrial cleaning and related operations.

44 HIGH-ALLOY CASTINGS — *Electro Alloys Div., American Brake Shoe Co., Elyria, Ohio.* 6-page folder entitled "Solving Corrosion Problems with Chem-alloy High-Alloy Castings", features two important charts that will help in selecting the right alloy for most corrosive conditions.

45 CYLINDER — *Ortman-Miller Machine Co., Inc., Hammond, Ind.* 12-page pamphlet gives dimensional data on the air, hydraulic and water cylinders. Cylinders feature all-steel body parts and flexible construction, permitting compact design and allowing cylinders to be applied in a minimum of space.

46 CLUTCHES — *Conway Clutch Co., Cincinnati 14, Ohio.* 14-page booklet illustrates and describes the Conway precision-built standard and disk clutches. Specifications and drawings are included.

47 AIRCRAFT STEELS — *Joseph T. Ryerson & Son, Inc., Chicago 80, Ill.* 64-page booklet contains descriptions and lists sizes, weights, lengths and extras of carbon, alloy, and stainless grades of aircraft-quality steel available from stock. A condensed listing of AN-QQ, Federal QQ, AN, and AMS Specifications pertaining to steel is included.

48 HYDRAULIC STANDARDS— *Miller Motor Co., Chicago 18, Ill.* 16-page booklet is entitled "The J.I.C. Hydraulic Standards for Industrial Equipment". Also included is a point-by-point comparison showing how Miller hydraulic cylinders meet the JIC standards.

49 RESISTANCE OF HIGH-NICKEL ALLOYS TO CORROSION — *International Nickel Co., Inc., New York 5, N.Y.* 44-page booklet P-8 is entitled "Resistance of Monel Nickel and High Nickel Alloys to Corrosion by Sulphuric Acid". Performance of over 30 different nickel bearing materials in a wide range of services. Included are 86 tables and 33 graphs.

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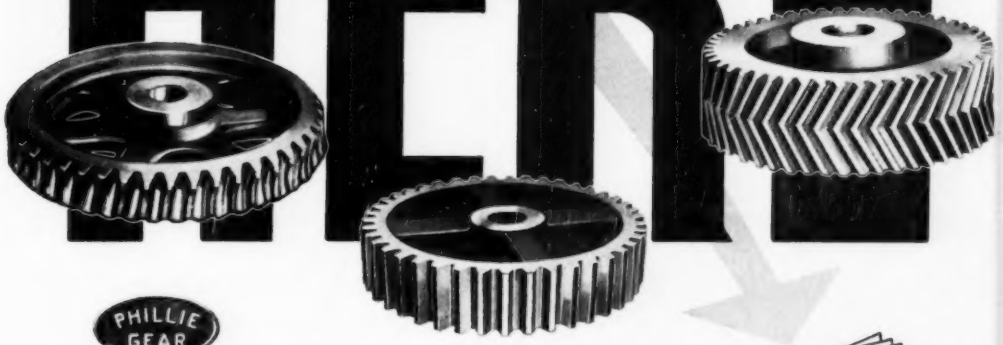

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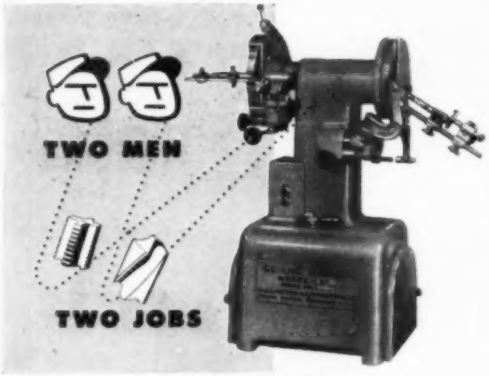

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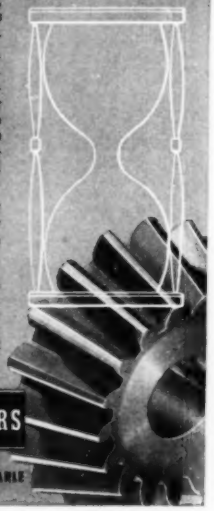

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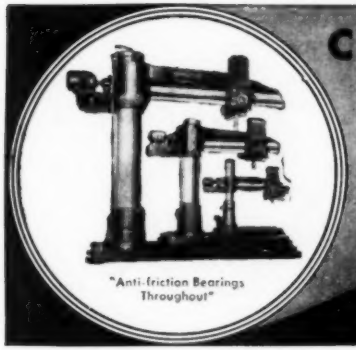

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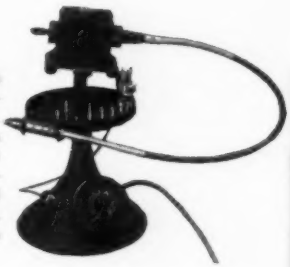

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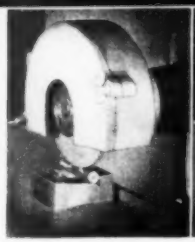
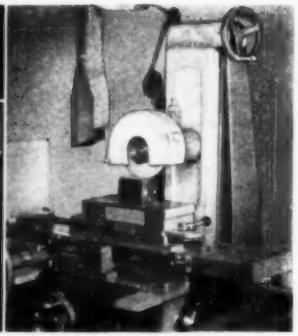


Grinding a lamination die section insert.

Grinding a flat on a lamination die punch.



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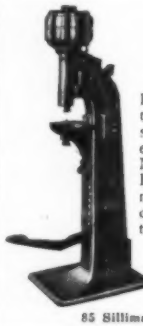

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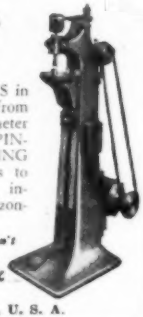

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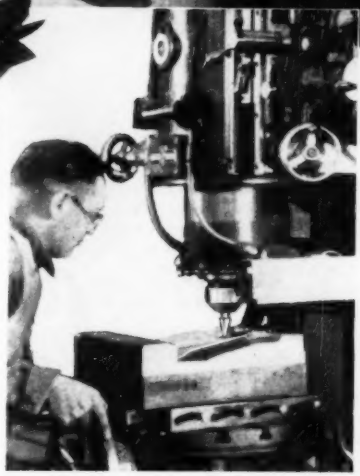

This T-J Cutter at work on a connecting-rod die block for a board drop hammer. Material being milled is "Hardtem" die steel. A cutter of right design and heat treatment for this high speed work in tough die steels, making possible maximum efficiency of these machines.

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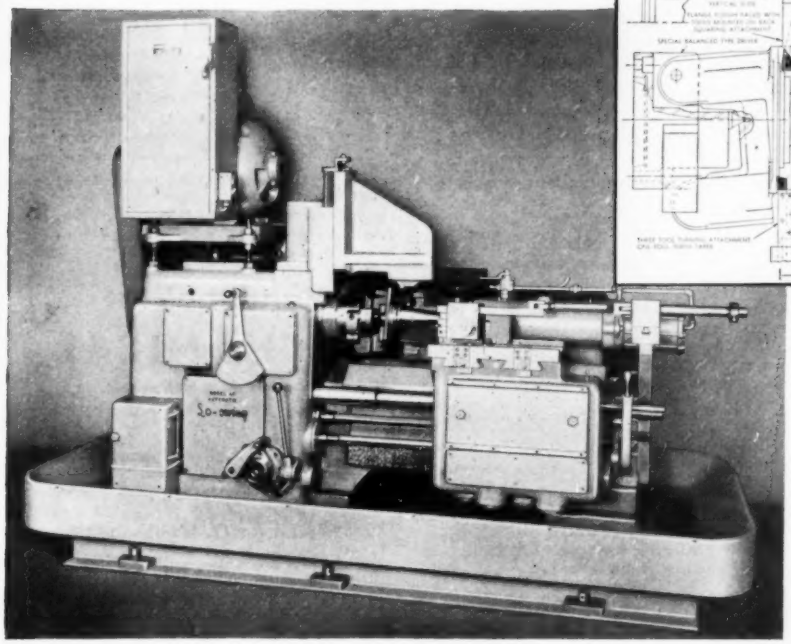

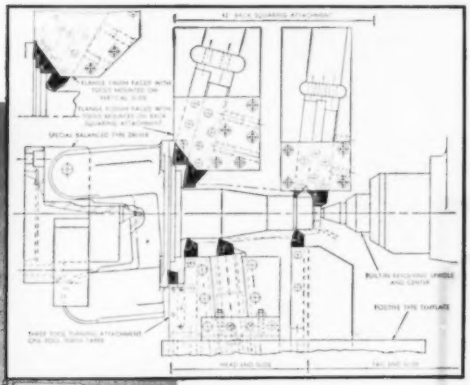

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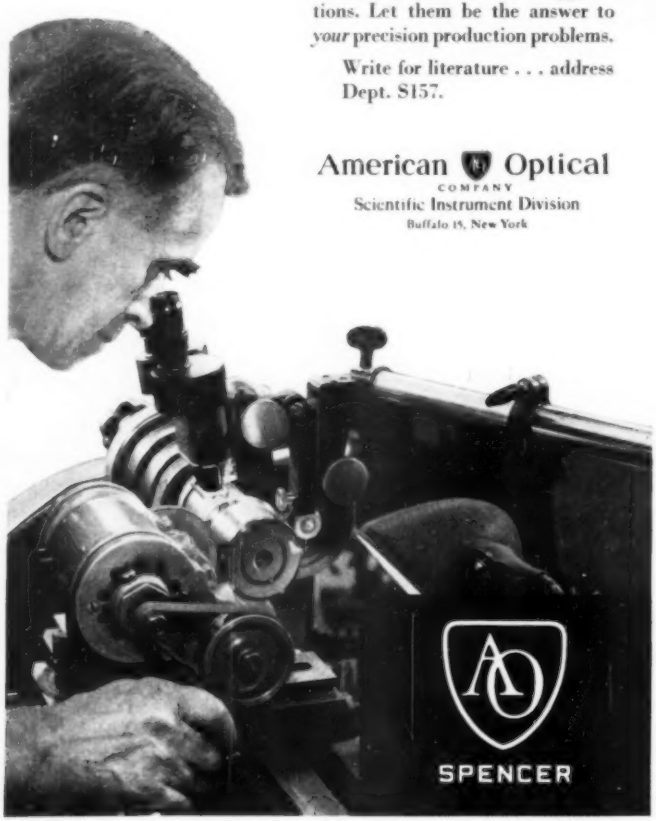

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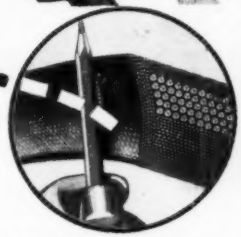

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Straight-Sided V-Belt

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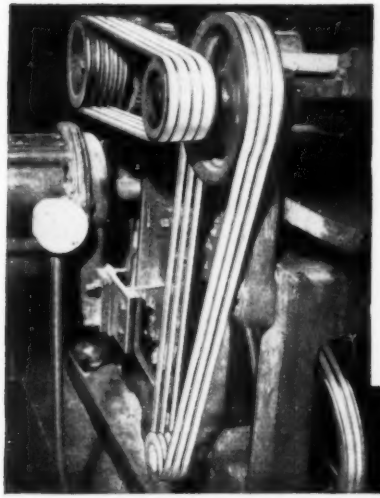

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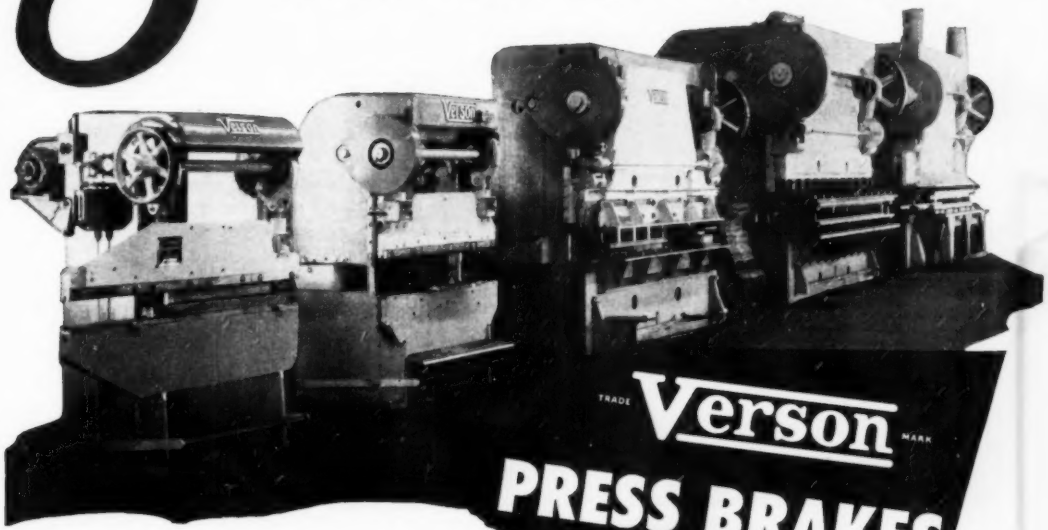

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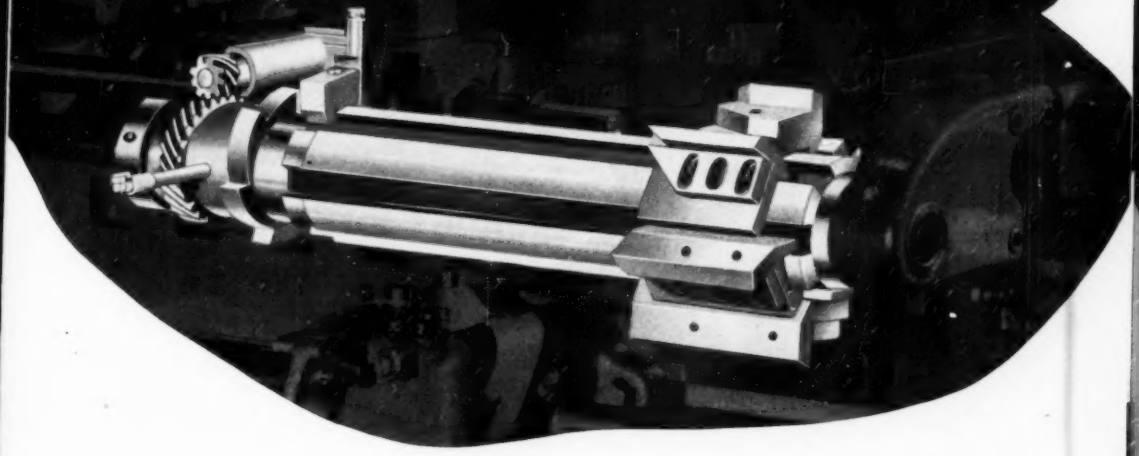

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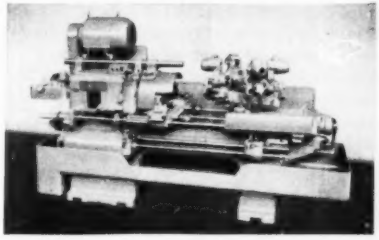

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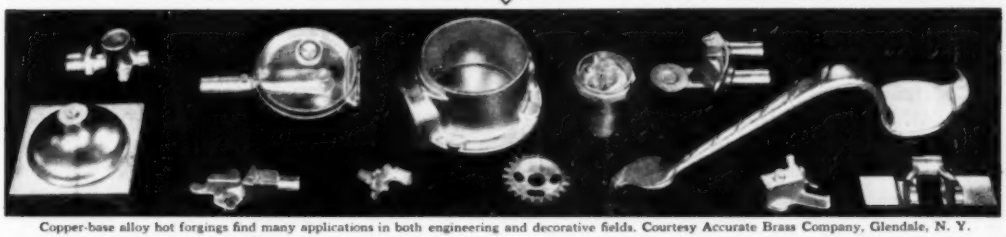

Copper-base alloy hot forgings find many applications in both engineering and decorative fields. Courtesy Accurate Brass Company, Glendale, N. Y.

Copper-Base Hot Forgings Find New Markets

Bigger, more powerful presses, tool steels capable of withstanding red-hot working temperatures and high pressures, clever tool designing and a wider range of copper-base alloys have all aided materially to the rapid advancement in hot forging.

Brass still takes the lion's share of the copper-base alloy forging business, but high-strength, corrosion-resisting engineering alloys, such as Silicon Bronze and Aluminum Bronze, have opened new avenues to designers.

Hot forgings for engineering applications have replaced sand-castings because of superior strength, greater density, freedom from porosity and more accurate dimensions. They are ideal for pressure pipe fittings, valves and controls for pressure vessels, propellers, pump components, wheels, gears, cams, fire fighting equipment, surgical and dental instruments, etc.

Now hot forgings have invaded the quality field of decorative items which call for attractive designs and highly-polished, beautiful finishes. Among these are: hardware items – door knockers, handles, lock parts, hinges and clothes hooks; candlesticks, frames, flanges, ornaments and novelties.

The service life of valves, pump parts, controls, hydraulic systems, etc., can often be increased by using hot forgings from Duronze III silicon aluminum bronze. This alloy has greater resistance to corrosion and wear and is stronger than most metals and alloys. Hot forgings average about 90,000 psi. Its high yield strength, fatigue and wear resistance values are desirable assets for engineering applications.

In the field of pole line hardware, Duronze III and Silicon Bronze No. 632 forgings are also helpful in cutting down excessive weight through improved physical properties. Their resistance to corrosion from weathering makes them excellent for outdoor construction and for use in equipment for water works, sewage and waste treatment plants.

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Copper	%	59.50	60.0	58.5	59.75	91.0	97.03
Lead	%	1.75	.15				2.85 Silicon
Tin	%	.20	.75	0.75			0.12 Iron
Zinc	%	38.55	39.1	39.45	40.25		
Iron	%			1.0		7 Aluminum	
Manganese	%			.3		2 Silcon	
Ten. Strength psi	Hard*	72,000	80,000	83,000	72,000	100,000	90,000
	Soft	52,000	55,000	72,000	54,000	85,000	55,000
Yld. Strength psi (@½% extens. under load)	Hard*	50,000	52,000	55,000	50,000	50,000	
	Soft	20,000	25,000	30,000	21,000	45,000	
Elongation % in 2"	Hard*	50	15	25	52	10	18
	Soft	45	50	45	50	30	55
Rockwell Hardness	Hard*	B78	B78	B85	B78	B95	B85
	Soft	F78	B50	B55	F80	B85	B50
MECHANICAL PROPERTIES AS HOT FORGED							
Ten. Strength psi			60,000			90,000	60,000
Yld. Strength psi			25,000			45,000	24,000
Elongation % in 2"			35			30	70
Rockwell Hardness			B52			B85	B35
Machinability Rating**		80	30	30	40	60	30
Cold Working		F	F	P	F	P	E
Hot Working		E	E	E	E	E	E
Hot Working Range °F		1200—1500	1200—1500	1150—1300	1150—1450	1300—1600	1350—1550

*Hard temper—values are for rod of commercial hard drawn temper. **Machinability Rating—Free cutting brass = 100. E—Excellent G—Good F—Fair P—Poor

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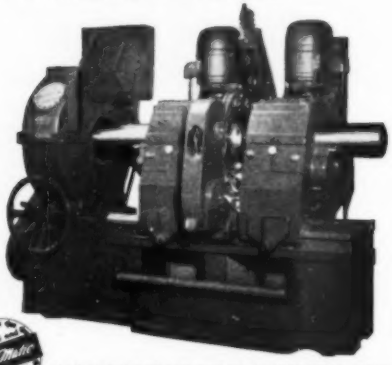
5 LOW MAINTENANCE COST
6 INTERCHANGEABLE FIXTURES



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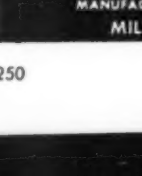
Double Chain Clamping Fixture with a total of 28 stations for milling ends of Clutch Gears — Production 200 gross per hour — With this arrangement two different parts can be milled simultaneously.



Double Drum—50 automatic holding fixtures on each drum for rough and finish milling radius on Rocker Arms — Production 1400 gross per hour.

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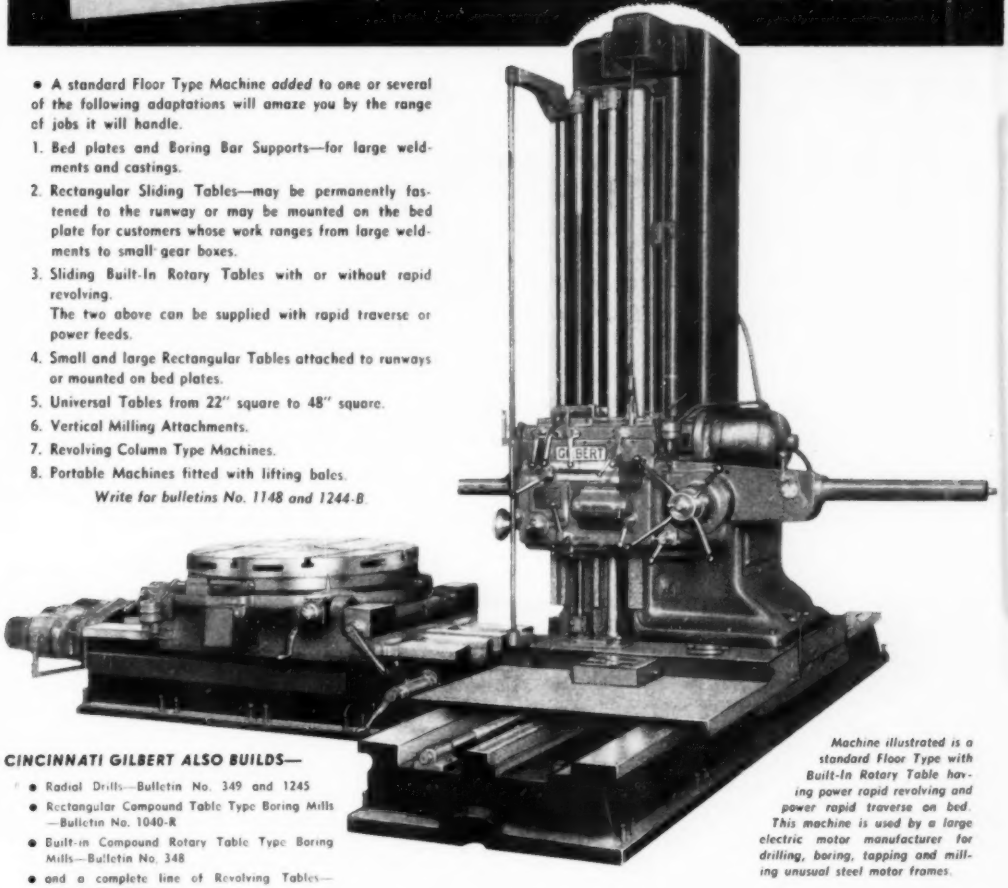

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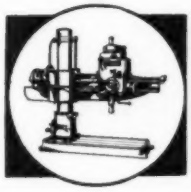

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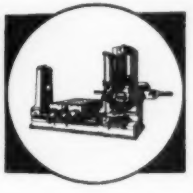

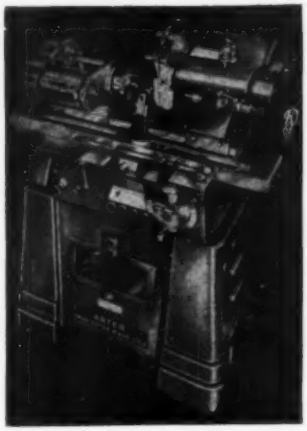

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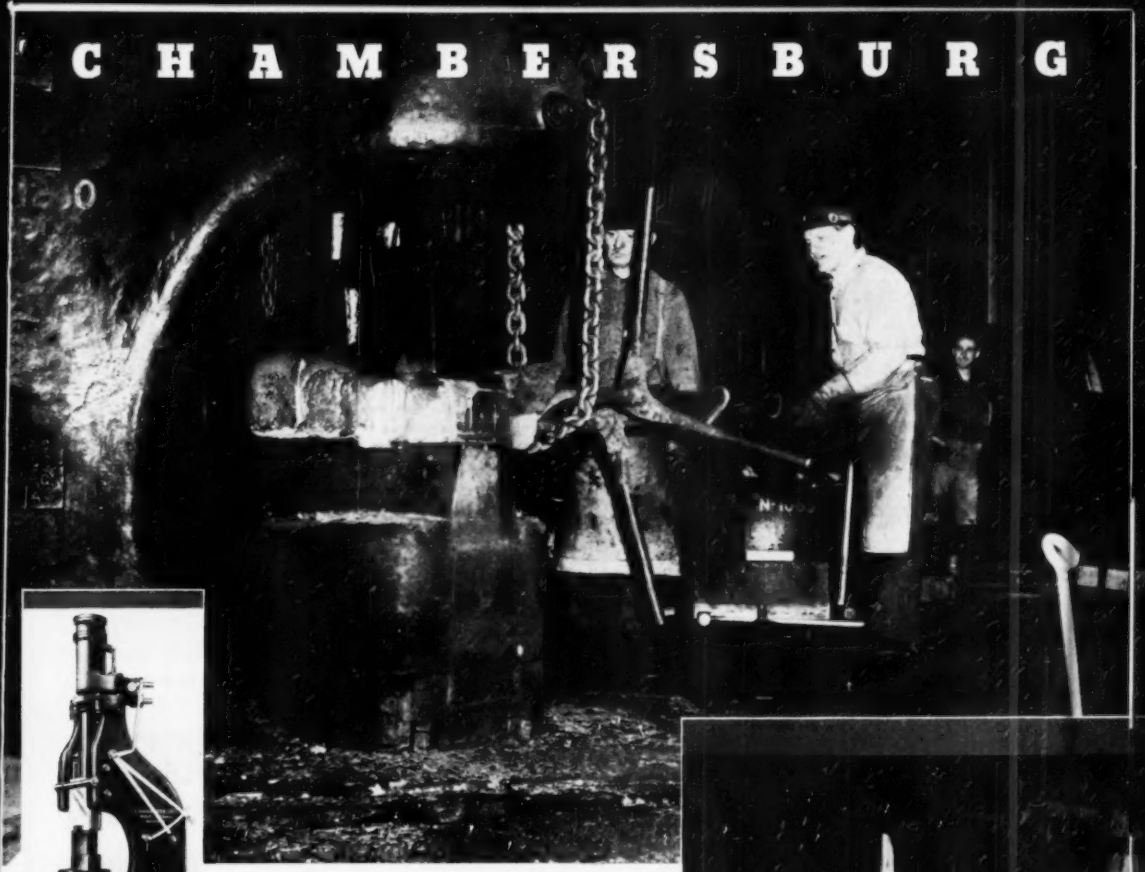

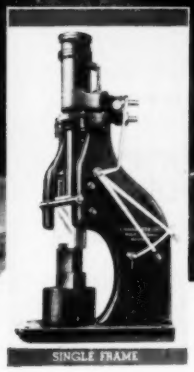

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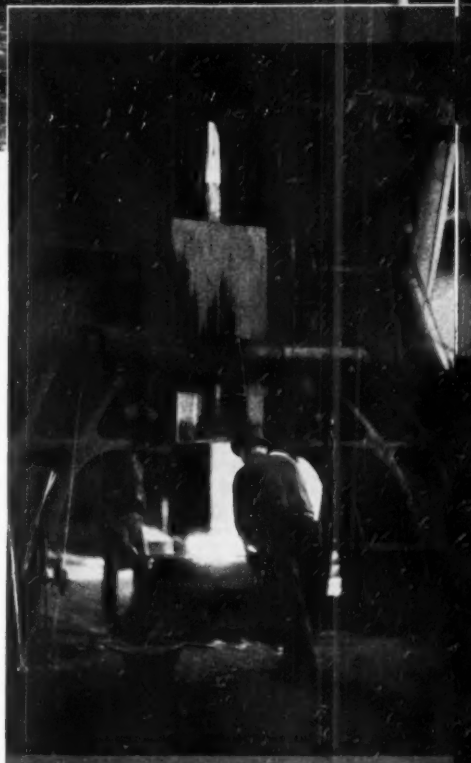

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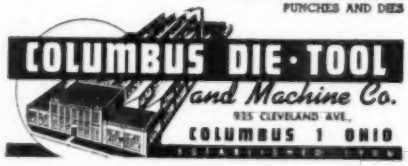

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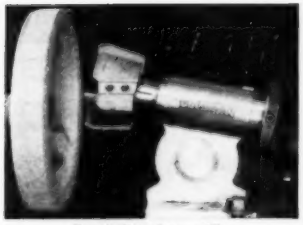
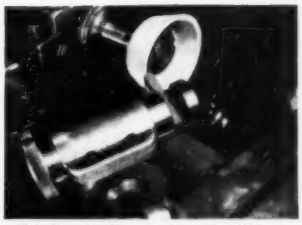


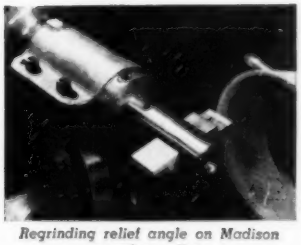
Regrinding face mill.



Grinding trailing angle and relief on tool bit.

Regrinding face of end mill.

Resharpening spiral milling cutter.



Regrinding relief angle on Madison reaming cutter.

Grinding lead angle on Madison roughing cutter.

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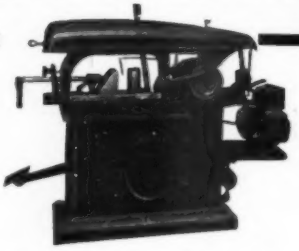

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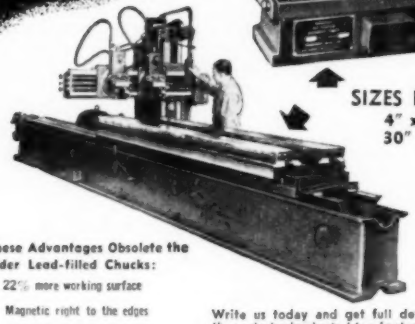

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BULLETINS ON REQUEST

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Fig. 55 Shank Type End Mill for Cast Iron

Fig. 41 Shell End Mill with High Speed Steel Blades

McCROSKY *Jack-Lock*® MILLING CUTTERS

Fig. 67 Face Mill for Steel

For All Steel, Cast Iron and Non-Ferrous Work

● You'll get more pieces per day—at lower cost per piece—with McCrosky *Jack-Lock* Cutters. This shop-proved construction holds the blades rigidly in the body yet permits easy release,—and extremely *uniform and accurate* adjustment for regrinding. There's no hammering or pounding. The blade stock ground away is much reduced. Blades last longer.

LOST CUTTING TOOLS

Bulletin No. 17-M | *Gives full details* | *Send for a copy*

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Jack-Lock® MILLING CUTTERS
Adjustable BLADE REAMERS
Quick-Change CHUCKS
Turret TOOL POSTS
Block Type BORING BARS
SPECIAL *Multiple Operation* TOOLS

STRAIGHT SIDE SINGLE CRANK PRESSES

for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

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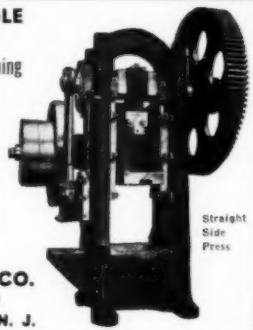

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The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

MODEL D-1 DIAL TYPE

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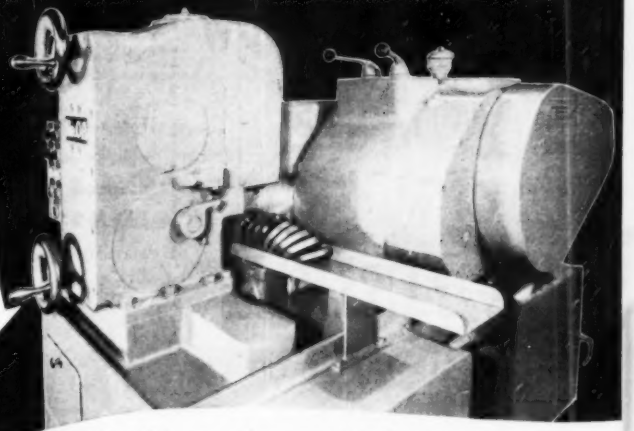
Reduce Cut-Off Costs Now!

and INCREASE Production



Use the MOTCH & MERRYWEATHER TRIPLE-CHIP METHOD and START SAVING IMMEDIATELY!

Triple-Chip vs. Alternate Method
(SAWING SAE 1020, 3¼" O. D.)

3/10¢ PER CUT

Triple-Chip Method cut off 1728 pieces before blade needed resharpening. Total tool cost per cut off piece, exclusive of labor and overhead, including pro-rated original cost of blade plus cost of resharpening—$.0029. Total tool cost for 100,000 pieces—$290.00.

1 3/4¢ PER CUT

Alternate method cut off 260 pieces for cost of blade. Blade "done for"; no resharpening possible. Total tool cost per cut off piece, exclusive of labor and overhead—$.0174. Total tool cost per 100,000 pieces—$1740.00.

Faster feeds and speeds are one answer to increasing production and decreasing costs. Lower tool costs are equally important. Use of the Triple-Chip Method insures that the cut off ends shall be square, clean with milled finish, and accurate to length, eliminating facing or squaring operations. In addition, the narrow kerf of the Triple-Chip blade reduces stock waste to a minimum. Take advantage of the Motch & Merryweather Triple-Chip Method. It increases production . . . lowers tool costs . . . saves time and material.

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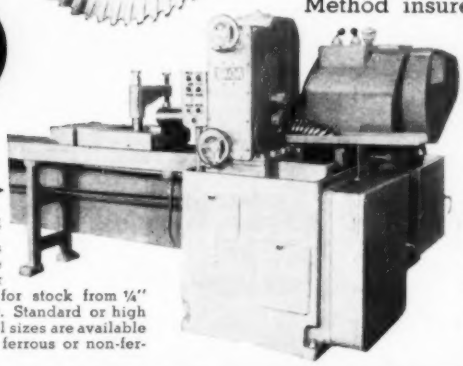
Triple-Chip METHOD



The Model O-A, with capacity to 4" round or square, is one of a complete range of circular sawing machines for stock from ¼" to 16½" diameter. Standard or high speed models of all sizes are available for sawing either ferrous or non-ferrous metals.

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Gives Jaws "Steel Finger" Action

- Tighter Gripping
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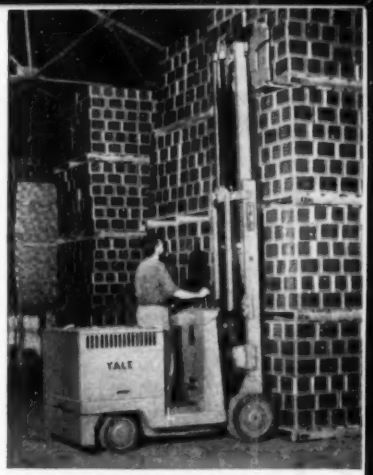
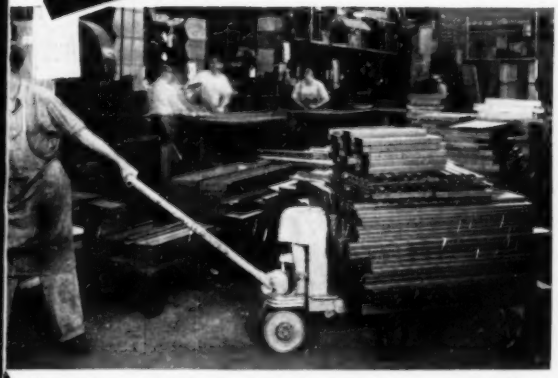
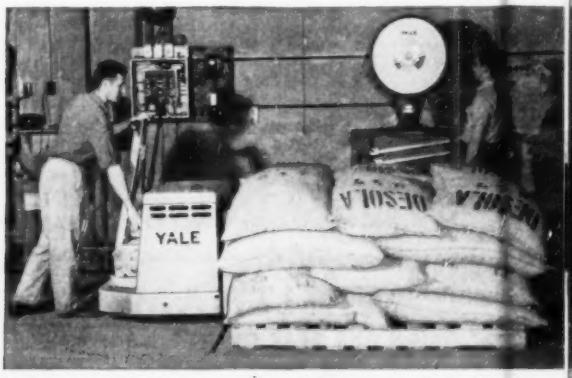


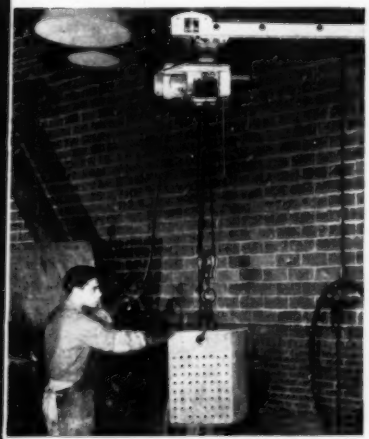
High stacking provides wider aisles, makes storage facilities hold more, saves the expense of new buildings. Yale High Lift Fork, Ram and Platform Trucks assure such efficiency.



Fewer trips per day, less lugging and tugging—big capacity Yale Hand Lift Trucks nail down costs by freeing men's time for productive work.



Multi-unit loads lifted and moved by Yale Worksaver Pallet Truck save time and effort, eliminate much costly, hazardous rehandling.



"Safety First" for worker and load—that's what easy-to-use Yale Hand and Electric Hoists provide, aside from their fast, money-saving efficiency.

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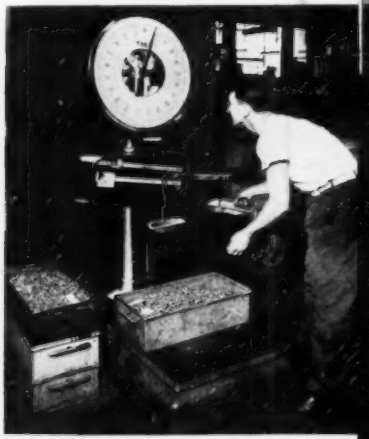

The difference between profit and loss often depends on accurate weight and count. Only Yale Load King Scales give you MAGNET-ROL weighing and counting accuracy.

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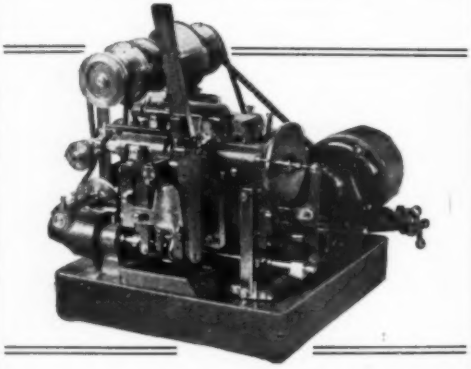

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Clean "shave" for a rusty blade in *16 seconds*

DIG into the making of high quality scoops and shovels and you'll unearth some interesting facts on their construction features.

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One of the important operations in their manufacture is that of thoroughly cleaning the shovel blades prior to painting. To insure a proper bond between the paint and blade, all traces of heat treat scale, oil quench residue and rust must be completely removed from the surfaces of both sides of the blade.

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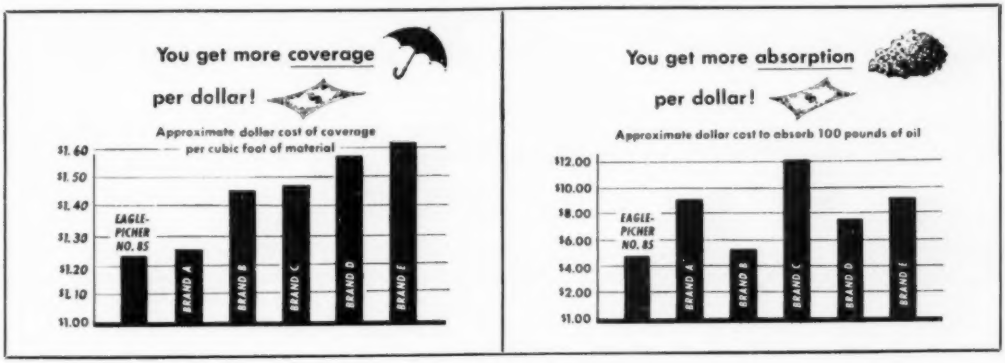

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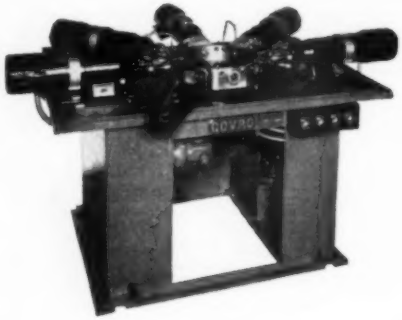

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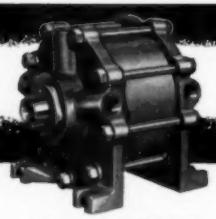

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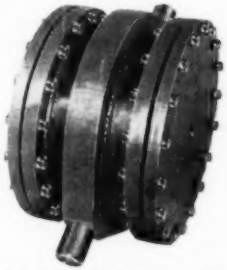

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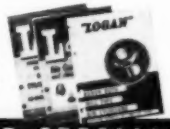

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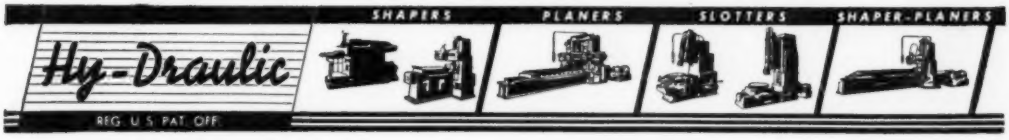

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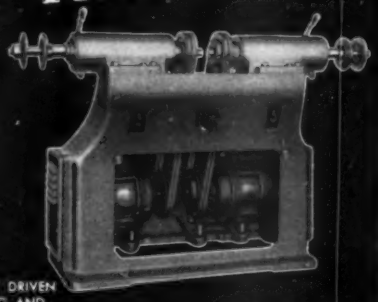

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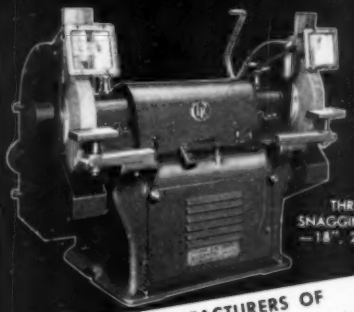

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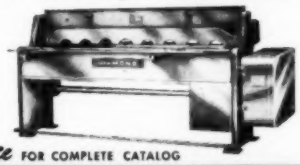

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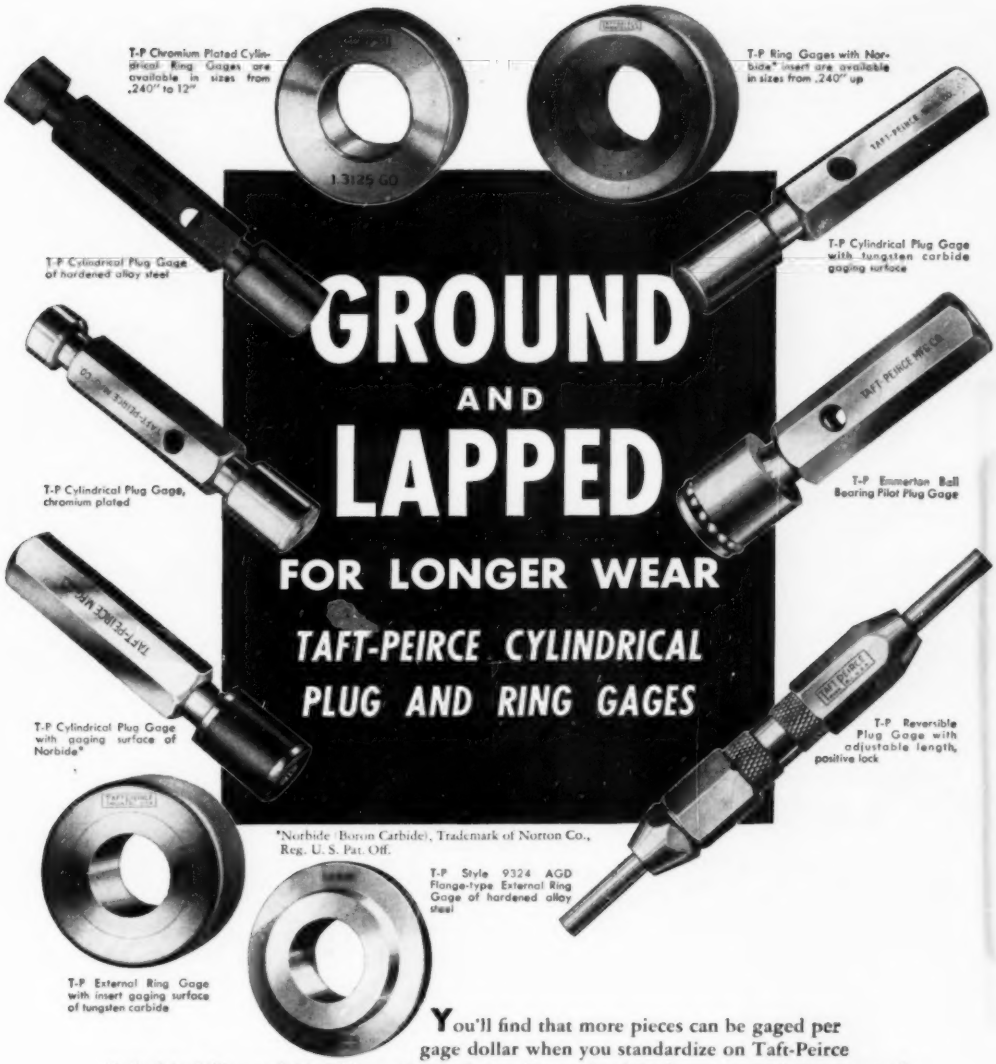
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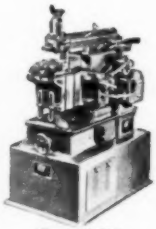

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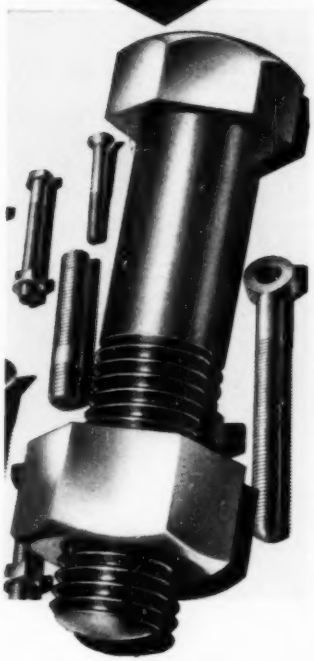

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6	1/4x 1/2	4.36	5.67	6	1/2x 1/2	6.50	8.45	6	3/4x1- 3/16	8.07	10.49
6	1/4x 9/16	4.36	5.67	6	1/2x 9/16	6.50	8.45	6	3/4x1- 1/4	8.07	10.49
6	1/4x 5/8	4.36	5.67	6	1/2x 5/8	6.50	8.45	6	3/4x1- 5/16	8.07	10.49
6	1/4x 11/16	4.36	5.67	6	1/2x 11/16	6.50	8.45	6	3/4x1- 3/8	8.07	10.49
6	1/4x 3/4	4.36	5.67	6	1/2x 3/4	6.50	8.45	6	3/4x1- 7/16	8.07	10.49
6	1/4x 13/16	4.36	5.67	6	1/2x 13/16	6.50	8.45	6	3/4x1- 1/2	8.07	10.49
6	1/4x 7/8	4.36	5.67	6	1/2x 7/8	6.50	8.45	6	3/4x1- 9/16	8.07	10.49
6	1/4x 15/16	4.36	5.67	6	1/2x 15/16	6.50	8.45	6	3/4x1- 5/8	8.07	10.49
6	1/4x1	4.36	5.67	6	1/2x1	6.50	8.45	6	3/4x1-11/16	8.07	10.49
6	1/4x1- 1/16	4.36	5.67	6	1/2x1- 1/16	6.50	8.45	6	3/4x1- 3/4	8.07	10.49
6	1/4x1- 1/8	4.36	5.67	6	1/2x1- 1/8	6.50	8.45	6	3/4x1-13/16	8.07	10.49
6	1/4x1- 3/16	4.36	5.67	6	1/2x1- 3/16	6.50	8.45	9	1/4x2	9.80	12.90
6	1/4x1- 1/4	4.36	5.67	6	1/2x1- 1/4	6.50	8.45	9	1/4x2- 1/4	9.80	12.90
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6	1/4x1- 5/8	4.36	5.67	6	1/2x1- 5/8	6.50	8.45	6	3/4x1- 1/4		
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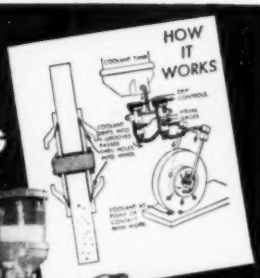

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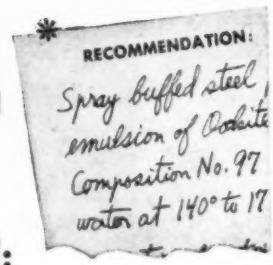
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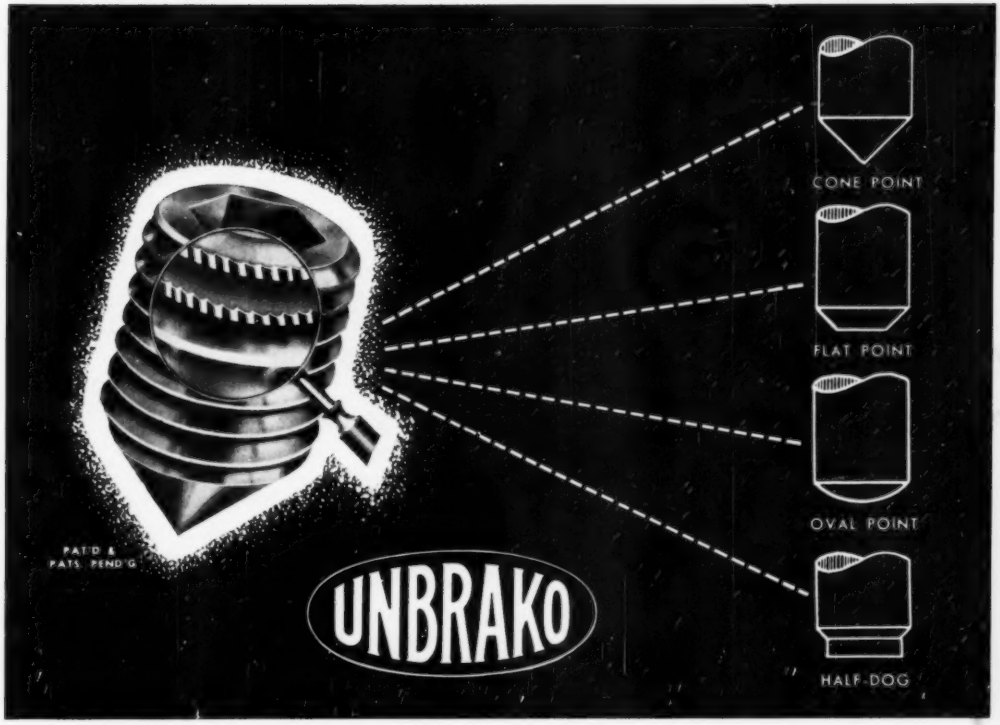

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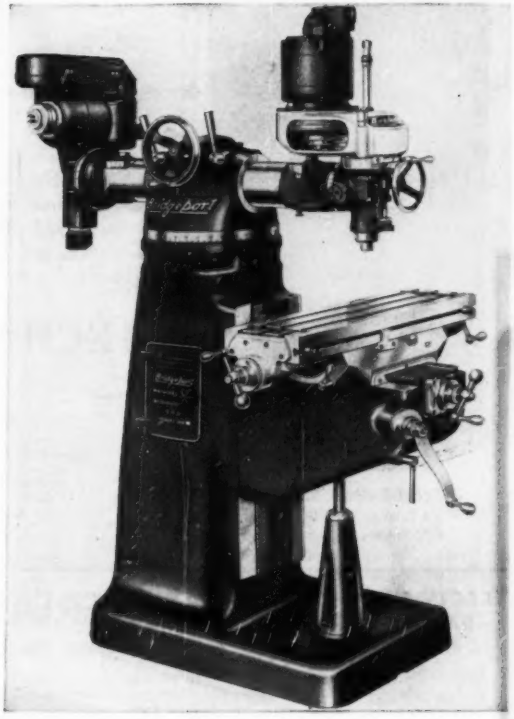

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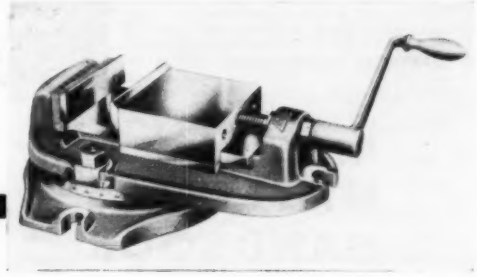

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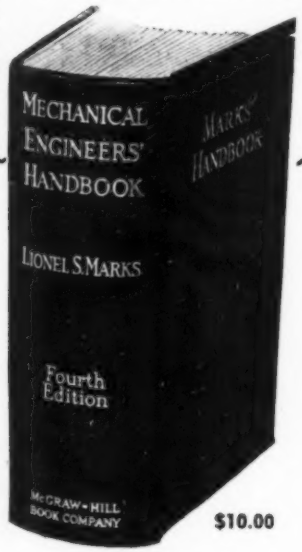

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SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service. 39 years recognized standing and reputation. The procedure of highest ethical standards is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and adress for details. R. W. Bixby Inc., 266 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

TOOL AND DIE Maker with sales experience, as demonstrator salesman or trouble shooter. Available to travel. Best of references as to stability and integrity. PW-8610, American Machinist.

METALWORKING ENGINEER, experienced in all types of metalworking processes and reduction of costs. 14 years in development, shop operation and management. M.E. and M.S. degrees from leading colleges. Highly trained in the tools of modern management. Now employed but available soon. Your opportunity to engage an unusual engineer as a project engineer or assistant works manager. PW-8657, American Machinist.

ENGINEER: AGE 28, aluminum, zinc die cast dies, tools and products, 18 years experience of design, shop and production. Desires responsible position. PW-8727, American Machinist.

ENGINEER—MECHANICAL 12 years' experience production, design, development, quality control. Thoroughly familiar machine tool, vending machine trades. Capable suprevising plant, training new employees. Presently located N.Y.C. Will relocate. Age 32, married. PW-8887, American Machinist.

POSITIONS WANTED

EXECUTIVE ENGINEER desires connection with medium size company to assume full responsibility as production manager, plant superintendent or chief engineer. 25 years of unique practical, design and manufacturing experience. Specalist in manufacturing of automatic machinery, instruments, tools, fixtures, precision gears. Thoroughly familiar with engineering and developing new products, purchasing, assembly, inspection, cost control, budget planning, plant engineering, labor relations, contract negotiations. Capable organizer with excellent record to get things done. Age 46. College Graduate M.E. Only permanent position considered. PW-8819, American Machinist.

TOOL SUPERVISOR available, methods, tool design, tool making, dies, jigs, fixtures, long continuous contact with metal working industry. PW-8840, American Machinist.

SHOP SUPT., 22 yrs. diversified machine shop experience in job shops manufacturing and erecting of heavy precision machinery, familiar with modern machine shop methods, ranging from blueprint stage through processing, design, tooling, estimating, plant layout, cost control, time study and labor relations. Age 40. Desires Chicago or Eastern locations. PW-8818, American Machinist.

SELLING OPPORTUNITY WANTED

MANUFACTURER'S REPRESENTATIVE, Northern Ohio territory. Experienced Mechanical Engineer wishes to handle machinery or machine parts used in manufactured equipment. Good contacts established through years of selling. RA-8832, American Machinist.

BUSINESS OPPORTUNITY

Mechanical Engineer

with shop and sales experience has $20,000 to invest in small going firm where services can be used to advantage. BO-8686, American Machinist.

PATENT ATTORNEY

Patent Practice

before U.S. Patent Office, Validity and infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine and Rommel, Registered Patent Attorneys, Suite 453, 815-15th Street, N. W. Washington 5, D. C.

FOR SALE

MACHINE SHOP at sensible price. Lathes, mill, grinder (cyl.), drill presses, shaper, planer, etc. Complete tooling and equipment. Grossed $90,000—1948. Low overhead. Smart operator can make money here. Write

BO-8828, AMERICAN MACHINIST
330 West 42 St., New York 18, N. Y.

WANTED

WANTED

1 Yoder type M 1½—8 roll forming machine or similar
1 Yoder size AC-1 automatic flying shear cut-off

Write or wire full particulars

THE GRABER COMPANY
MIDDLETON, WIS.

WANTED GENERATORS

FOR RESALE: Late type 3" Gleason Straight Bevel Gear Generators. Give serial, motor specifications, tooling, condition and best price.

W-8856, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED

1 42" or 54" Bullard Vertical with Spiral Drive and Fine Feeds 1940 or newer.

W 8866 AMERICAN MACHINIST
330 W. 42 STREET, NEW YORK, N. Y.

CONTRACT WORK

AN IMPORTANT MESSAGE TO MANUFACTURERS
(WITH OR WITHOUT THEIR OWN FOUNDRY)

CIRCULAR IRON CASTINGS

can, in most cases, be made by us *without patterns*, thus saving time, trouble and money.

Yes, fine quality, accurate iron castings for Pulleys, Flywheels, Gear Blanks, etc., can be made by us in most any size and quantity. (We've been doing such work for 92 years.)

Send us sketch or blueprints for prices.

T. B. WOOD'S SONS CO.
CHAMBERSBURG, PA.

KAMIS
ENGINEERING COMPANY
DESIGNERS & MANUFACTURERS of TOOLS and MACHINERY

We have open capacity for machine work on the following facilities:

36" to 54" Vertical Boring Mills
3" to 5" Horizontal Boring Mills
#2 to #5 Vertical and Horizontal Millers
10" to 50" Engine Lathes

SEND FOR BROCHURE #4 WHICH DESCRIBES OUR FACILITIES IN DETAIL.

THIRD & MOORE STREETS
PHILADELPHIA 48, PA.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us – we will take care of them
GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

SIMMONS ENGINEERED Machine Tool REBUILDING NEWS

SIMMONS MACHINE TOOL CORPORATION • MAIN OFFICE AND PLANT, 1759 N. BROADWAY, ALBANY, N. Y.

Late-Type Boring, Milling & Threading Machines

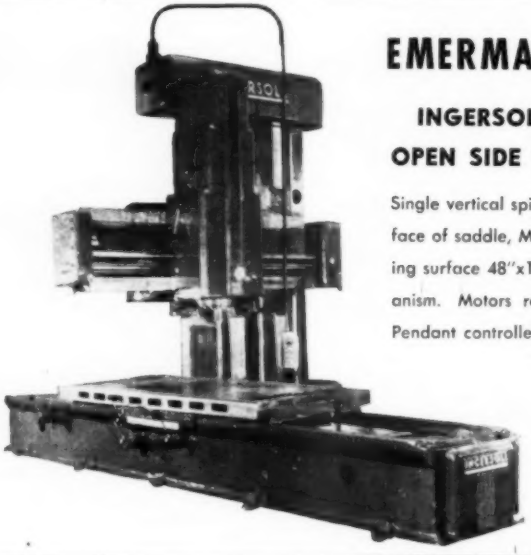
Two excellent Late Type Horizontal Boring, Milling and Threading Machines with auxiliary high speed spindles.

5" Spindle NILES "Timesaver" Horizontal Table Type Boring, Milling and Threading Machines, with 2⅝" high speed spindles. Forced feed lubrication, all geared feeds and speeds. Power rapid traverse throughout.

SPECIFICATIONS

ITEM #8577		ITEM #8578	
Table work surface	60"x96"	Table work surface	60"x96"
Table cross travel	84"	Table cross travel	84"
Table longitudinal travel	92"	Table longitudinal travel	36"
Saddle travel on column	72"	Saddle travel on column	60"
Spindle nose to outboard bearing	144"	Spindle nose to outboard bearing	96"
5" spindle speeds 18, RPM	6 to 240	5" spindle speeds 18, RPM	5 to 210
2⅝" spindle speeds, RPM	24 to 1060	2⅝" spindle speeds, RPM	20 to 840

NEW YORK CITY OFFICE: 50 EAST 42nd STREET



EMERMAN *Offers from* STOCK

INGERSOLL VERTICAL ADJUSTABLE RAIL OPEN SIDE MILLING AND BORING MACHINE

Single vertical spindle. 5" boring bar. Height from top of table to face of saddle, Max., 48"; Min., 3½". Bed length 20'. Table working surface 48"x10'. Table feeds obtained by Johnson drive mechanism. Motors required: 5 H.P. DC, 10 H.P. AC, 15 H.P. DC. Pendant controlled crossrail and clutch. Weight about 59,000 lbs.

EMERMAN
MACHINERY CORP.
875 W. 120th STREET
CHICAGO 43, ILLINOIS

Nos. 1, 2, 3 & 5 W & S Turret Lathes.
No. 13 B & S Universal Grinder, M. D.
No. 4 Cinn. High Power Vertical Mill.
Norton 6" x 18" Type C Hyd. Grinder.
D. E. DONY MACHINERY CO.
47 Laurelton Rd., Rochester 9, N. Y.

SHEET METAL MACHINERY
NEW and USED — HAND and POWER. Apron Brakes, Press Brakes, Shears, Formings Rolls, Power Presses, Pittsburgh Lock Machines, Spinning Lathes, Spot Welders, etc.
MONA MEMBER
B. D. BROOKS, INC.
361 Atlantic Ave., Boston 10, Mass.

Bar. Mill. Hor. 3" G. & L MD. 4½" N-B-P—MD.
Boring Mills. 24"-30"-42"-52"
Drills, Radial 3'-4'-5'-6' Cin.-Bick.
Lathe, Turret 3-A W and S. G.P.D.
Millers, Plain No. 3 K and T. No. 4 Cin.
Millers, Vertical No. 3 and No. 4 Cin.
Shaper, 18"-28"-24"-36".
Shaper, 36" Morton Draw Cut.
Shears, 42"-90"-72"-132"
West Penn Machinery Company
1210 House Bldg. Pittsburgh, Pa.

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MACHINERY COMPANY

18 WARD ST.
ROCHESTER 5
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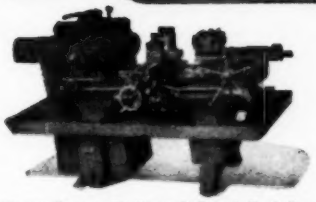
Every Item Guaranteed as Represented



Warner Swasey #3 Unversal Geared Head Bar Feed Ram Type Turret Lathe. Late Type. 3/60/220/440 volts motor. FIVE AVAILABLE—some have tooling.

TURRET LATHES

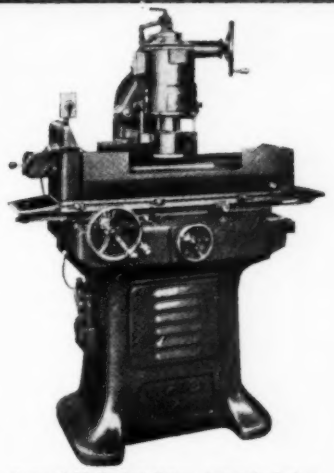
Bardons & Oliver #1 Electric Turret Lathe. ¾" cap. Has bar feed & collets.
Morey #2 Geared Head 1" Cap., M. Dr.
Simmons Microspeed 1" Cap., M. Dr.
Oster #601 Hand Screw Machine 1½" cap.
W-Swasey #4 Univ. 1½" cap., M. Dr.
Jones & Lamson #3 Univ. Bar Feed 1½"
W-Swasey #3 Univ. 1¼" cap., M. Dr.
Gisholt #4 Univ. 2" cap., M. Dr.
Bardons & Oliver #7, Univ. 2½" Cap.
W-Swasey #3A Univ. 3½" cap., M. Dr.

Dreis & Krump #458D Motor Driven Power Press Brake. Serial #5439. 7½ h.p. 3/60/220/440 volts motor. Also ram motor. Push button controls. Capacity—8'x¼" steel and lighter. Takes 8'6" between housings. Throat—8". Stroke—3". Die Space—12". 30 strokes per minute. Has Standard Die Holders, also Adjustable gauges.

Barnes #307 Single Spindle Hydraulic Twin Cylinder Vertical Honing Machine. Late Type complete with coolant system and 220/440 volts motors and controls. Six speeds, #5 morse taper. TWO AVAILABLE. One has Positive Depth Stop & Dwell.

ENGINE LATHES

36"x30' LeBlond Geared Hd. Motor Dr.
32"x16' Bridgeford, Geared Head, M. Dr.
28"x10' Davis Quick Change Gear
26"x18' Bridgeford, Geared Head, M. Dr.
26"x14' Lodge Shipley, M.Dr. 8'2½" c.c.
25"x14' LeBlond, Taper Att. 8'2" c.c.
24" x 16' American Q.C.G. Motorized Cone Head. 11' centers. Taper Attachment, 24" chuck, faceplates, cabinet type legs. 220/440 volts motor & controls.
24"x14' Lodge & Shipley, Motorized
24"x12' Putnam Motorized. On raising blocks to swing 32" with 66" c.c.
20"x11' Schumacher-Boye, Q.C.G.
20"x10' American, Q.C.G. 72" centers
20"x10' Hendey Motorized.
20"x8' Lodge & Shipley, Q.C.G. M. Dr.
18"x8' Davis Q.C.G. 42" centers, equipment
18"x8' Lodge & Shipley, geared head
18"x8 Hendey Q.C.G. 49" centers
18"x6' American, Geared Head, M.D.
16"x12' South Bend Q.C.G. Enclosed Head Underdriven with 1½ h.p. motor & controls. 105½" centers. NEW—1946. Has chuck, turret tool post, 2-steady rests, faceplates. Excellent condition. Immediate delivery from stock.
16"x8' Hendey Q.C.G. M. Dr.
16"x6' Lodge & Shipley Geared Head
16"x6' Lodge & Shipley "Patent Head", Motor Dr.
16"x6' South Bend Enclosed Head, Motor driven. Taper Attachment, Chucks, Collets & Quick Acting Collet Chuck.
14½"x6' South Bend Enclosed Head, Motor Driven. Taper Attachment, chucks, Turret Toolpost Threading Dial, Ram Type Turret Attachment, collets & Collet Chuck.
14"x8' Reed-Prentice Eight Speed Selective Geared Head, Q.C.G. Mater driven w/220/440 volts motor & controls. Has Taper Att. chuck, faceplates, steady rest, cabinet legs, max. centers —48". Completely rebuilt. Immediate shipment.



Norton 6x18 Vertical Rotary Automatic Surface Grinders. 220/440 volts motors. Excello Spindles. Hydraulic Table feeds. Three Available with immediate delivery.

GRINDING MACHINES

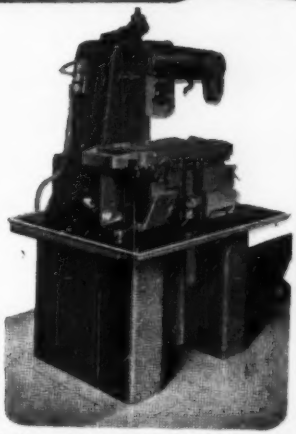
Brown & Sharpe #10 Cylindrical 6x18
Brown & Sharpe #11 Cylindrical 10x30
Brown & Sharpe #4 Univ. Cylindrical 12x60
Brown & Sharpe #5 Plain Cylindrical
Oliver of Adrian #51 Drill Grinders
Thompson 6x18 Hydraulic Horiz. Surface. Wet & dry work. 220/440 motor driven. Auto. downfeed to head. Motor driven exhauster unit.
NEW—Leach 6x12 Horiz. Surface. 220 volts motor, ball-bearing Spdle. Permanent magnetic chuck. Immediate shipment from stock.
Norton 6x36 Horiz. Surface. 220/440 volts motor. Has extra grinding wheels and 40x9 chuck. For wet & dry work. Excellent condition.

AUTOMATICS

#0G & #00 Brown & Sharpe Automatic.
#2G Brown & Sharpe High Speed Automatic Screw Machine. Serial #6814. Self-contained 5 h.p. 3/60/220/440 volts motor drive & controls. Complete coolant, toolposts, gears, collets. FOUR AVAILABLE.
#2 Brown & Sharpe Automatic. Turner drive 220/440 volts motor. With Stock stands, collet, toolposts, coolant system, change gears. FOUR AVAILABLE.
Cleveland Model "A" 3¼" capacity Single Spindle Motor Driven Automatic. Has lot of tooling, collets, motors and switches & coolant system.

PUNCH PRESSES

Niles Bement & Pond Horiz. Hydraulic Wheel Press. 200 tons capacity. 48" between strain bars.
Bliss #18, #20, #208, #21 O.B.I. Motorized.
Ferracute #86 Wide Frame, motor driven. 61½" between housings. 13¾" stroke.
Michigan O.B.I. 36 tons cap. 2" stroke. Wide Ram, wide Bed. Motor driven
Ferracute #P4 Backwheel Type. 8½" Throat. 50 Tons Cap. 2" stroke. 15" x 24" bed area. 220/440 volts motor & controls.
NEW Johnson O.B.I. Presses. All sizes.
Bliss #305 Geared S.S. Single Action
Nilson 56 tons S.S. Dbl. Crank 3-Die Transfer Press
Toledo #5 O.B.I. 44 tons capacity. Motor Dr.
Federal #3 O.B.I. 26 tons capacity. Motor Dr.



Cincinnati #0-8 Automatic Horizontal Motor Driven Milling Machines. Some with Rise & Fall Mechanism. FIVE AVAILABLE.

MILLING MACHINES

Nichols Hand, Late Type, M.D. (six)
Sundstrand #0 Rigidmil, M.D.
Whitney #6 Hand, Cone Drive
Hardinge B.B. Vertical, Bench
Becker #5C Vertical, Cone Dr.
Knight #1½ C Vertical
Cincinnati #3 & #4 Vertical. Dial Type
Cincinnati #3, #4, #5 Pl. Horiz.
Brown & Sharpe #12 Production. 18" Autom.
Brown & Sharpe #12 Production. 24" Autom.
Brown & Sharpe #0, 1Y Horizontal
Kempsmith #1, #2 Plain Horiz.
Cincinnati 18" Mfg. Plain
Milwaukee #2K Vertical, M. Dr. Dial Type
Milwaukee #3K Vertical, M. Dr. Dial Type
Milwaukee #1½ Dbl. Overarm, Horiz.
Milwaukee #2B Dbl. Overarm, Horiz.
Milwaukee #3B Plain Horizontal
Pratt & Whitney #2 Duplex, Motorized
Cincinnati #0-8 Vertical. Motor driven. (EIGHT AVAILABLE)

UNIVERSAL MILLING MACHINES

Ames Bench, 12" x 3" x 7½" W/Index Hd.
Index #40H, 16"x8½"x16"
B & S #2, 20"x5"x17½"
B & S #1½", 20"x7"x18"
Bridgeport, 20' x 9' x 16" Turret Type.
B & S #1D, 24"x8"x15"
Garvin #2MU, 24"x8"x18"
K & T "Milwaukee" #2, 28"x10"x17"
Kempsmith #2, 28"x8½"x18"
Cincinnati #2, 28"x10"x18"
Cincinnati #2M, 28"x10"x18"
B & S #3, 34"x10"x21"
Cincinnati #3S, 34"x12"x20"
Some w/index heads & equipment

SHAPERS

Shaper—Columbia 32" B.G. Crank, motorized Power downfeed to head.
Shaper—Logan 7" Horizontal. NEW
Shaper—Machinery Sales 16", motorized
Shaper—Gould & Eberhardt 16", motorized
Shaper—Smith & Mills 16", motorized
Shaper—Smith & Mills 16" Universal
Shaper—Gould & Eberhardt 18" B.G. Crank
NEW—Gemco 20" Universal Shaper, M. Dr.
Shaper—American 24" crank, motorized

DRILLING MACHINES

American 4' Arm, 11" Col. Motor on Arm Radial. #5 M.T. has M. Dr. Coolant system.
Cinci-Bickford 6' Arm, 15" col. Radial
Cinci-Bickford 5' Arm, 13" col. Radial
Fosdick 5" Arm 14" col. Radial
Cinci-Bickford 3' Arm, 9" Col. Radial. Motor driven. W/table. 12 Speed gearbox.

EASTERN OFFERS FROM STOCK

AUTOMATICS
No. 4D Potter & Johnston, m.d., latest (4)
8 spindle 1⅝" Cone, m.d., latest
4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
No. 5D2-1⅝" Potter & Johnston, m.d., air chucks, 1944 machine
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Fay, Flanders Type, m.d.
20x25" Jones & Lamson, m.d., latest
4 spindle ⅞" Model R-4 Acme-Gridley, m.d.
4 spindle 2½" Cleveland Model "K", m.d.
2½" Gridley Single Spindle, m.d.
2½" Cleveland Model A, m.d.
4½" Cleveland Model A, m.d.
4½" Cleveland Model A, m.d.
5½" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7¾" Cleveland Model A, m.d.

BOLT MACHINES
Victor Nut Facing Machine, m.d., latest
¾" Style R Economy Automatic Threading Machine, belt drive
3 spindle 1¼" Acme Bolt Threading Machine, cone

HORIZONTAL BORING MILLS
3½" bar Cincinnati-Gilbert Floor Type, m.d., latest
No. 0 Giddings & Lewis, m.d., 3½" bar
2½" Cleveland, m.d.
No. 25T Giddings & Lewis, m.d., 2½" bar, latest
No. 31 Lucas, 3" bar, m.d.
No. 33 Lucas, 4½" bar, m.d.
No. 45 Giddings & Lewis, m.d., 5" bar
4" bar Detrick & Harvey Floor Type, m.d.
5½" bar Niles, m.d.
10" bar Sellers Floor Type, m.d.

VERTICAL BORING MILLS
24" Bullard New Era, m.d., with side head
36" Bullard Spiral Drive, m.d., with side head
36" Bullard New Era, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Bullard Spiral Drive, m.d., with side head
42" Colburn, H.D., m.d., 2 swivel heads
48" Cincinnati Rapid Production, m.d., 1 turret head, 1 swivel head
48" Colburn H.D., m.d., 1 turret, 1 swivel head
48" Putnam, H.D., m.d., 2 swivel heads
54" Colburn, m.d., 1 turret, 1 swivel head
84" Niles H.D., m.d., 2 swivel heads, p.r.t.
100" Niles Heavy, m.d., 2 swivel heads, p.r.t.
100" Niles Extra Heavy, m.d., p.r.t., late
120" Niles Heavy, m.d., 2 swivel heads, p.r.t.

BROACHING MACHINES
No. 4 Oil Gear Hydraulic, m.d., 64" stroke
No. 4 LaPointe of Hudson, gear box
No. 75 H.P. LaPointe Horizontal Hydraulic, 120" stroke, 37½ tons cap.
Cincinnati Mill Broach, m.d., 10" spindle, new

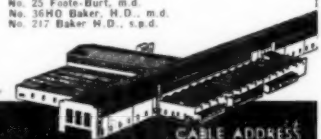
BALL BEARING DRILLS
2 spindle 21" Canedy-Otto, m.d., No. 4 Taper
No. ½, 1, 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
No. 2—12" Foote-Burt Single Spindle, m.d.
No. 4 Fosdick, 8" overhang, belted m.d., No. 2 Taper
No. 4BM—24" Fosdick, m.d., latest
No. 5M—16" Fosdick, m.d.
2 spindle No. 3 Avey, belted m.d., p.f.
3 spindle No. ½ Avey, Heavy, direct m.d., latest
4 spindle No. 2 Motor Avey, all power feeds, latest
4 spindle No. 2 Avey, belted m.d.
6 spindle Leland & Gifford, No. 2 Taper, m.d. on each spindle
6 spindle 2B Edlund, m.d., No. 2 Taper
6 spindle Heavy & Wright Class B, m.d., No. 2 Taper
6 spindle No. 3 Avey, belted m.d.

HORIZONTAL DRILLS
No. ½Bx30" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. ½Bx50" Pratt & Whitney Chambering Machines, m.d., latest
No. ½Bx50"—No. 1Bx50" Pratt & Whitney Deep Hole Drill, m.d., latest
No. ½Bx50" Pratt & Whitney Gun Barrel Rifling Machine m.d., latest
No. 1Bx74" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. 1 Pratt & Whitney 2 spdle. Deep Hole Drill, m.d.
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest
No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1½ Pratt & Whitney 2 spindle, m.d., older type
Pratt & Whitney Rifling Machine, belt
5 spindle Detroit Semi-Automatic Drill, belt
No. 6 Barnes Twin Spindle Honing Machine, m.d.
2 spindle No. 410 W. F. & John Barnes Deep Hole Drill, m.d.

MULTIPLE SPINDLE DRILLS
No. 3 Baush, m.d., 18x30" head, 15 spindles
No. 3 Baush, m.d., 20x40" head, 15 spindles
P7 Baush Hyd., m.d., 20x30" head, 12 spindles, latest
D13H Natco Hydraulic, m.d., 18x12" head, 10 spindles
No. 16 Fixed Center Foote-Burt, m.d.
3 spindle 24" Barnes All Geared Self-Oiling, m.d.
3 spindle 12" Rockford Gang, m.d.
4 spindle Foote-Burt Rail, No. 4 Taper, m.d.
4 spindle Niles-Bement-Pond H.D. Rail, m.d., 12' rail, No. 5 Taper

RADIAL DRILLS
4'-11" col. Morris, m.d. on arm, latest
2' Fosdick, 9" col., gear box
3' American Sensitive, cone
3'-10" Fosdick, gear box
4' American Sensitive, m.d. on arm
4'-11" Carlton, gear box, inclosed head
4'-12" Fosdick, gear box
4'-13" American, gear box
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, 13" col., gear box
5'-13" Cincinnati-Bickford, m.d.
5' Cincinnati-Bickford Full Universal, gear box
5' Cinn.-Bickford Plate Hole Driller, m.d. on arm
5' Prentice, Plain, m.d.
6'-15" Carlton, gear box, inclosed head
6'-15" Cincinnati-Bickford, with 7' arm, m.d.
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
7'-17" Droses, gear box, m.d.
8'-16" American Triple Purpose, m.d. on arm
10'-22" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS
20" Barnes All Geared, m.d., tapper
21" Cincinnati-Bickford, m.d., tapper
24" Cincinnati-Bickford, m.d.
30" Rich, H.D., m.d.
H3 Barnes Hydram, m.d.
D4 Colburn H.D., m.d.
D8 Colburn H.D., m.d.
No. 25 Foote-Burt, m.d.
No. 36NO Baker, H.D., m.d.
No. 217 Baker H.D., s.p.d.



We carry an average stock of 2,000 machines in our 11 acre plant at Cincinnati. Let us quote on your requirements.

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio — MElrose 1741 — CABLE ADDRESS EMCO

Late Type — EVERY MACHINE TESTED AND GUARANTEED AS REPRESENTED — *Immediate Delivery*

LATHES
HENDEY 12"x42" tool room (1947)
PRATT & WHITNEY 14"x30" Model C (1946)
SOUTH BEND 10"x35½", 14¾"x60", 16"x84"
BRADFORD, 16"x6'
HENDEY 16"x6', taper attach.
RIVETT No. 608 taper attach. precision
LE BLOND "REGAL" 17"x4'
ELGIN & HARDINGE PRECISION, 1" cap.
PRATT & WHITNEY 10"x20", precision
PRATT & WHITNEY 13"x6', taper attach.
SEBASTIAN 12"x6' GH M.D.
AMERICAN 18"x8' M.D.
SPRINGFIELD 16"x6', Motor in Base, 12 speeds
MONARCH 14"x8' GH TA
AMERICAN 20"x13' GH., QC. TA.
REED PRENTICE 20"x8'. Late, 1943.
HARDINGE Precision second operation

TURRET LATHES
GISHOLT bar equip. preselector, #5, #1L
WARNER & SWASEY #1A chucking
FOSTER #5 universal, bar feed
WARNER & SWASEY #1, ⅝" cap. hand.
BROWN & SHARPE #1 Hand Screw
HARDONS & OLIVER #5 Preselector 2" cap.

SHAPERS
Gould & Eberhardt, 20" Industrial
Stockbridge, 16" M.D.
Smith & Mills, 16" (1946)

DRILL PRESSES
American Radial, 4'x11" column
Asey, #2 single spindle, 15" overhang
Allen, 6 spindle, #2, 12" overhang
Buffalo #22 BG, PF, #4 MT.
Cleerman drill box col. 25", #4M.T.
Walker-Turner Radial ½ H.P.
Canedy-Otto 21" Sliding Head Box, Col. 2 Sp. No. 4 M.T.

AMERICAN HOLE WIZARD RADIAL DRILL 6"x15" col.

GRINDERS

Cincinnati Universal Grinder 12"x36" ext. int.

NORTON #2 Universal Hydraulic Tool & Cutter
COVEL #91A & #6 tool & cutter universal
HEALD #72A3 plain internal, HYDRAULIC
BLANCHARD VERT. SURFACE, #16, 24" chuck
BLANCHARD, VERT. SURFACE, #11, 16" chuck
BROWN & SHARPE, #5 surface hydraulic
REID, SURFACE, 2B Pope spindle (1946)
RIVETT #104—Int.—Ext. Latest
BROWN & SHARPE #2 & #2B Surface
Excello Thread Grinder #31
GALLMEYER & LIVINGSTON 12x24 Hydraulic
Do-All Hyd. Surface Grinder 6"x18"
Wicaco Precision Internal
Cincinnati cylindrical 12x72" centers
GARDNER 3B Polishing Lathe, Dust Collector

BOREMATICS AND BORING MILLS
Defiance #25A Horizontal 3½" Bar
Lucas No. 41, 3" cap. extra long table

AUTOMATIC SCREW MACHINES
BROWN & SHARPE, #00, ⅝" cap.
BROWN & SHARPE, #2, high speed
BROWN & SHARPE, #00, high speed ⅝" cap.

PLAIN MILLERS UNIVERSAL
BROWN & SHARPE, #3B, PLAIN
BROWN & SHARPE, #3, UNIVERSAL
CINCINNATI, #2MH, Universal, Vertical Attach.
VAN NORMAN #2 and #12, #22LU and #36SU
VERNON Miller, motor in base
CINCINNATI #3 plain M.D.
PRATT & WHITNEY #12B Profiler 2 sp.
LEES BRADNER Thread Miller 12"x54" HT
MILWAUKEE #5H Dial Type (1946)

VERTICAL MILLERS
CINCINNATI, #3, #4, dial type
VAN NORMAN, #3V, rapid traverse
KEARNEY & TRECKER, #3KM, dial type
KEARNEY & TRECKER, #3H, dial type
PRATT & WHITNEY Jig borers #2
SIP SWISS Jig Borer #5B Univ. Tilting Table
GORTON #8D Vertical high speed, powerfeed
DECKEL engraving machine model G-1L., 50-1 Ratio

PRODUCTION MILLERS
CINCINNATI #1-12 automatic
KEARNEY & TRECKER #1H-18 Mfg. type
BROWN & SHARPE #000, high speed

GEAR MACHINERY
FELLOWS #C1A
GLEASON 24" cap. Bevel Gear Cutters
GOULD & EBERHARDT, #735, spur gears
Barber Coleman #12, 12" cap.
Gleason 7" straight bevel & 2" spiral bevel
Gleason Gear Tester

MISCELLANEOUS
Niagara 6'x10 gage, 16" gap
Ruesch #2 percussion press, 60 ton
Standard Jewelers Roll 2"x8" Rolls

ROW BOTTOM CAM MILLER

THIS IS A PARTIAL LISTING—TREMENDOUS STOCK ON HAND—YOUR INQUIRIES WILL RECEIVE OUR PROMPT AND COURTEOUS ATTENTION

CAPITOL MACHINERY CORPORATION

253 CENTRE STREET — PHONE WO. 4-7615-6 — NEW YORK 13, N. Y.

MONA MEMBER

LATE TYPE MACHINERY AT OLD TIME PRICES

AUTOMATICS

Brown & Sharpe #09G, H.B., #4, #6
Conomatic 8 sp. 1⅝" cap.
New Britain Gridley 6I—6 Sp. 2¼"

BORING MILLS

Bullard 24", 42" New Era V.T.L.
Giddings & Lewis #0, #25T
Lucas #31 horiz.
Universal 3" horiz.

DRILLS AND RADIALS

American Hole Wizard 3'-9" col., Amer. 4'-13" col.
Barnes #262, 26" #5 M.T.
Canedy-Otto 3'-9" col.
Carlton 8'-1" col., Foote-Burt 6 Sp.
Cinci-Bickford Super Service, 21", 24"
Delta Bench & Floor Models single & 4 spindle
Natco Model E-5 Multi-Spindle, 14 spindles
Royersford Excelsior 21" Back Geared, P.F.
Sibley 24—2L", Sliding Head, Allen 6 Sp.

ENGRAVERS

Gorton #3U, 3Z 2 dimensional; #3L, 3 dimensional
Gorton Cutter Grinders 375-2, 265-5

GEAR EQUIPMENT

Fellows #72, 725 High Speed
Mikron Gear Hobber
National Broach Checker; Michigan, Gleason

GRINDERS—Miscellaneous

Black Diamond #1 Drill
Brown & Sharpe #5 cyl., 3"x18"
Brown & Sharpe #1, #2, #3 Univ., #13 Univ. & Tool
Cincinnati #2 Centerless Filmatic, 12"x36, 12x48" Univ.
Covel #81A Univ. Tool & Cutter, Hammond #4 Carbide
Gardner #226, 30" disc, Heald #1 Tool
K.O. Lee Tool & Cutter
Landis #4H Cyl. 4x12", Landis #6 Thread, Centerless
Norton #2 Tool & Cutter
Norton Cyl. 6x18" Type C, 6x30" Type C
Oliver #510 Drill Pointer, Sellers #4G
Pratt & Whitney Radius #R6, Gremby Int.
Porter Cable Belt WG8, G8

GRINDERS—Surface

Abrasive #1½" Wet Hand Feed, #34 Vertical
Atlantic 6x18" Power Feed, Foote-Burt Hammond
Blanchard #18—42" Chuck
Brown & Sharpe #2, #5 Hyd. 8x24" Cap.
G. & L. #18, 6x18" Hand Feed, #25, #35 Hyd.
Hanchett #300, 13x48"
Mattison 14x16x48 Hyd.
Norton 6x18" Hyd.
Pratt & Whitney 12x36" Vert.
Reid #2A P.F., #2C Pope & Excello Spdl.
Thompson Hyd. 6x10x18", 6x12x18

LATHES

Bradford 15"x6', Hardinge Precision 9", cabinet
Hardinge Precision 9", cabinet
Hendey G.H. 16x30 Relieving Attach.
LeBlond Regal 10"x3½", 15x30", 19x48", 21x60"
LeBlond Heavy Duty 16x33"
Lodge & Shipley 16x78" T.A.
Monarch 10"x20" EE, 16x78" T.A., 12x30" CKK
Rivett Precision, Logan 10"x30"
South Bend 9"x3', 9"x3½', 13x36", 16"x7', 14"x6'
Sebastian 12"x4', G.H., Sheldon 11x24, 1" collet
South Bend 10" Toolroom 1" collet capacity, T.A.

LATHES—Turret

Acme #6W Bar & Chuck, 6W Fox Lathe
Bardons & Oliver #3, #5, Foster #3B
Brown & Sharpe #1, 2F Hand Screw Mach.
Gisholt #4, 5 Bar & Chuck
Hardinge ESM Second Operation
Jones & Lamson #8A Univ. Saddle Type
Oster #60I Rapiduction, Morey #3, 1½" cap.
Warner & Swasey #3 Universal, #4 Pre-Selector, #4A

MILLS—Plain & Universal

Brown & Sharpe #2 Pl., #2A Univ.
Burke #4 Plain & Univ., Vert. Hds.
Cincinnati #3 Plain, 2MH Univ.
Milwaukee #2HL, 2H, Plain
Milwaukee #2HL, 2H, 3H Univ.
Van Norman #12, 20, 22L, 36

MILLS—Vertical—JIG BORERS

Bridgeport vertical with Slotting Attach.
Brown & Sharpe #2, Index Vernon
Cincinnati #4 Dial Type, Jackson
Kearfney & Trecker #5H, 3H
Gorton #8D, 9J Plain
Gorton #8½D Duplicator Fully Equipped
Fosdick Jig Borer #42 Like New
P&W 1½B Jig Borer
Sip Jig Borer #MP-5
Moore Jig Grinder
Morey #12M Profiler 2 sp.—Pratt & Whitney 12B

MILLS—Production

Brown & Sharpe #000, 12, 21
Cincinnati #1-12, 1-18, 2-18 Mfg.
Kent Owens #1V, 2-20
Nichols Hand, Vert. Hd., U.S. MM 1
Sundstrand #00 Rigidmills, U. S. Duplex

PRESSES

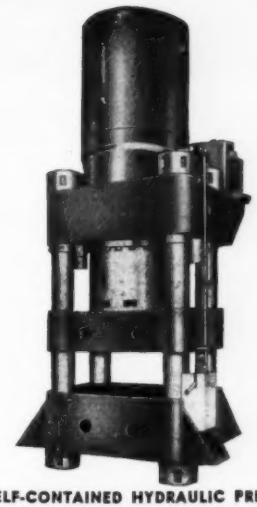
Bliss #8 Dbl. Crank, Bed 42x100", 250 Ton
Bliss #675, 645B, 650 Hi-Production
Bliss #20, 21 O.B.I., #4½ Double Action Cam
Bliss #56 O.B. Gap Frame #62, 62A, 162
General Flexible Elec. Screw
Henry & Wright 25, 60, 75 Ton Dieing
Thomas 7A, 80 Ton O.B.I.
Toledo 400 Ton Knuckle Joint #663
V. & O. #25B O.B.I., #102 Reducing
Z & H 30 Ton O.B.I.

MISCELLANEOUS

BAND SAW: DoAll Metalmaster, Tannewitz #36M
BENDING ROLL: Buffalo #0, Excelsior #14
BROACH: 3L LaPointe Horiz. Hydr.
FILER: Oliver, HEAVY DUTY
HACKSAW: Marvel #6A Automatic, #6, #4B
HARDNESS TESTER: Rockwell 4JR, Clark
HAMMER: Niles Bement Pond 2500 lbs. steam
HAMMERS: Rochester Rivetting, Hi Speed, Grant
HONER: Micromatic #H-1 Hydrohoner, Sunnen
INJECTION MOLDER: Reed-Prentice #10D6, 6 ounce

NEW IN STOCK

Air Hydraulic Presses—Arbor Presses #6C Famco, ⅓ off list price—Band Saws Kalamazoo 8x16", 8x24"—Drill Presses all sizes—Grinder Surface, Abrasive #1½—Hydraulic Press Northern 20 Ton — Injection Molders, 1 ounce — Power Presses, Famco 4½, 7½ Ton, Rousselle O.B.I. & Horn 5, 10, 15, 25 Ton, Pressrite OBI, 5, 10, 12, 18, 30 ton cap.—Shaper, 7" Ammco, 8" Shaprite, Sheldon 12"—Shears Foot 22" to 8', 16 & 18 ga., Shears, Power, 3'x18 gauge to 10 x 10 ga.—Welders, Arc, Seam, Spot all sizes—Vert. Milling Attach. Haloo, HS 5 & 10 Speed—Motors, Grinders, Buffers, all sizes.



SELF-CONTAINED HYDRAULIC PRESS

HYDRAULIC EQUIPMENT

Cap.	Manufacturer	Platen	Stroke Opening
500 Ton	Lake Erie	35x36"	36" 68"
600	Bald. S'thw'k	76x59"	22" 30"
500 D.A.	H.P.M. (100 Cushion)	36x36"	24" 30"
1000	French Oil	53x42"	20" 50"
360	Brand New Watson Stillman Hobbing Press		
375 D.A.	Elmes (60 Cushion)	84x44"	12" 42"
350	Verson	40x40	36" 72"
50	Dennison	22x20	18 23
150	Southwark	34x30	30 2" to 4'

UP MOVING RAM PRESSES

50 & 100 Ton Stokes Molding Presses & Pumps
300 Ton Dunning & Boschert Molding Press
500, 800 Ton Waterbury-Farrel 3 & 4 Rod Presses, 6 & 6½" strokes
300 Ton Watson Stillman Press, 24x20" Platens
400 & 500 Ton Shaft Straighteners—Self Contained

All Hydraulic Equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your Hydraulic problems.

IRONWORKER: Buffalo 25U x 20 Univ.
KEYSEATER: Mitts & Merrill, Baker Davis
PRESS BRAKE: #253, #335 Chicago
ROUTER: Onsrud #W240, #55 Oliver
SAWS: Wells, Catskill, Kal.
SHAPER: 8" Shaprite, Ammco, Atlas
SHEAR: Pexto, 6'x14 Ga. Power
SHEAR THROATLESS: #138 Lenox
SPEED LATHES: Cincinnati, Schauer
TAPPERS: Bakewell #1, Haskins #2C, 3C
THREAD ROLLER: Waterbury-Farrel #30 with Dies
THREADERS: Oster Pipe & Bolt
WELDERS: Seam; Thompson
WELDERS SPOT: Taylor-Winfield 50 KVA, Sciaky
WRAPPING ROLL: Buffalo #½

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WRITE FOR OUR FREE ILLUSTRATED CATALOG

AARON MACHINERY CO., Inc.

45 Crosby Street
WOrth 4-8233

New York 12, N. Y.
Cable: AARMACH, N. Y.

MDNA MEMBER

BETTER PERFORMANCE at Lower Cost

LATHES

Reed-Prentice model-AA, 16"x8', 16-speed, 54" C. Dist., 1945
Reed-Prentice model-B, 16"x8', 16-speed, 54" C. Dist., 1942
Pratt & Whitney model-B, 16"x36", 16-speed
Monarch 14"x30" Type-C, 16-speed, Taper attachmt.

Niles-Bement-Pond 48"x24', Gr. Hd., 15' C. Dist., D.C. motor drive
Bridgeford 36"x36', 15-speed Gr. Hd., 48' C. Dist, Taper Attchmt.

Fay & Scott 20"x42" Back Grd., M.D. Extension gap Lathe, 8'0" C. Dist Gap closed, 12'8" C. Dist Gap open

TURRET LATHES (all late type)

Jones & Lamson #5 Ram Type, bar equip., 3" hole
Bardons & Oliver #3 Univ., bar equip., 1⅞" hole
Gisholt #5 Univ. Preselec. Hd., chucking
Foster #5 Ram Type Univ., bar equip., 2" cap.

PRODUCTION LATHES (late type)

Jones & Lamson 12"x81" Fay Automatic, 1945
Sundstrands #8, 15" and #10, 22" Automatic Stub
2—W. C. Lipe 12"x18" Carbo Lathes
Seneca Falls 8"x108", "Lo-Swing"

GRINDERS (universal)

Cincinnati 12"x30" and 12"x36" Hydraulic Univ., complete with full Univ. equip. (late)
Brown & Sharpe #2 Univ. with equip. (late)

Brown & Sharpe #13 Univ. & Tool, quantity of tooling (late)

GRINDERS (Surface)

3—Norton 6"x18" Horizontal Hydraulic, Pope Spindles
Thompson "BB", 12"x14"x24" Horizontal Hydraulic
Blanchard #11 Rotary Surface, 16" chuck (late)
Blanchard #16 and #16A Rotary Surface, 30" chucks

GRINDERS (Plain & Misc.)

Farrel 30"x182" Motor Driven Roll Grinder, Max. length face ground 182", Max. dia. ground 30", Min. dia. ground 9", floor space 26'x10'—Net wt. approx. 31,000 lbs.

Norton 10"x36" Type-A Plain Cylindrical M.D.
Norton 10"x18" and 10"x36" type-C Plain (late)
Brown & Sharpe #5, 4"x18" Plain (late)
Cincinnati #2 Centerless, Filmatic Bearing, long bar attchmt., auto. infeed attchmt.

DRILLS (Radial)

American 3'8", "Maxi-Speed", M.D.
Cinn-Bickford 4'9" Super Service, mono-arm Control (late)
Cinn.-Gilbert 4'11" motor-on-arm (late)
Morris 4'9", "Mor-Speed" motor-on-arm (late)

DRILLS (Mult. Spindle)

Foothurt #3, 12", 6-spindle, Power feed Sensitive (equal to new)
Leland-Gifford #3, 12", 2 and 4-spindle, belted M.D., Back Gr., Power Feed (late)
Avey #3, 12", 2-spindle, MA-6, Power Feed, motor spindles (late)

BORING MILLS (table type)

Defiance #5, 3" bar, 1942
Universal 4" bar, "Triway", added vertical range
Defiance #25A, 3½" bar, added vert. & cross range
Yoder #3A, 3" bar
Giddings & Lewis #0, 3" bar, M.D.

MILLERS (univ.)

Cincinnati #3S Rect. Over., motor-in-base, attchmts.
Brown & Sharpe #2 Light Type, full univ., equip.
Milwaukee #2 "Standard" Dbl. Over., motor-in-base
Van-Norman #2SU, complete with attchmts
Van Norman #36SU Ram type, attchmts (1945)
Van Norman #22L Ram type, attchmts
Pratt & Whitney #1½-B Jig Borer, Rotary Table, gauges, indicators and quantity of tooling.

MILLERS (Plain)

Cincinnati #3 Dial Type, Hi-Speed, Vert. Hd.
Brown & Sharpe #3B Dbl. Over., motor-in-base
2—Brown & Sharpe #2 Light Type
Milwaukee (K&T) 2HL Hi-Speed

PLANERS

Cincinnati 28"x56"x22' Dbl. Housing, 4 hds., M.D.
Woodward-Powell 48"x48"x14' Dbl. Housing, 4 hds., Rev. M.D.
Woodward-Powell 36"x36"x10' Dbl. Housing, 3 hds., M.D.
American 30"x30"x11' Openside, M.D.

PRESSES

Billings & Spencer #2 Trimming, 3½" stroke, M.D., side shear
Farquhar 100-ton, 36" stroke, Hydraulic Drawing (late)
Reliance #45, 45 ton O.B.I. Hydraulically operated clutch, Hi-Speed (late)
Toledo #59, 250-ton S.S., Dbl. Gr., 4 pt. Tie Rod Constr., M.D., 18" stroke

HAMMERS & FORGING MACHINES

Chambersburg "F", 1200# Board Drop
Billings & Spencer "D", 1200# Board Drop
Chambersburg 4000# Board Drop
Standard 1200# Board Drop, 1943
United 2000# Board Drop
Bradley 300# Upright Helve
National 3", 5" and 7½" Upset Forging Mch.

MISCELLANEOUS

(new) Rafter Power Squaring Shears—available in two sizes:
¼"x10' mild Steel
⅛"x10' stainless steel
3 /16"x12' mild steel
3 /32"x12' Stainless Steel
Immediate delivery from stock.

2—Potter-Johnston 6DRE Automatic Chuckers
National-Acme RA-9/16", 6-spindle Screw Mch. (late)
Bliss 2-high, 10" Cold Rolling Mill (extra set of rolls)

This is only a partial listing — for complete information — write, wire or phone (WOrcester 6-5175)

Botwinik Brothers of Mass., Inc.
3 SHERMAN ST. • WORCESTER 1, MASS.

National Bent Shank Nut Tappers Battery of ⅝" to 1" Machines.

Waterbury-Farrel Fdry. ⅝" and 1" D.S. S.D. Cold Headers, also Thread Rollers.

Fisher 5" Bar, Floor Type Boring Mill. New in 1942.

Niles, Bement, Pond 60"x60"x24' table 4-Head Planer, Rev. D.C. M.D.

Bliss Presses in all sizes up to 1,000 ton capacity.

Wire Working Machinery.

National Machinery Exchange
128-138 Mott St., New York 13, N. Y.

Metal Forming and Bending Machine
#206-F Toledo 135 Ton D.C. Press, 3" Stroke 20" x 110" Bed Area
¼" x 144" Dreis & Krump Squaring Shear
Roller Type Slab Miller 22" Slab capacity
12 Spindle Moline Automatic Drilling Machine
3 Spindle Moline Model 7-D Cylinder Borer
1-A W&S Universal Turret Lathe
16" x 14' Schumacher & Boye Engine Lathe
Libby 26" x 4½" Spindle Turret Lathe
26" Stockbridge Shaper
Lees-Bradner CT 36" Thread Millers
10" x 48" Roll Grinder
Foote-Burt 4 Spindle Drill #2 M.T.

CONTINENTAL SALVAGE & MACHINERY CORPORATION
1836 EUCLID AVENUE, CLEVELAND 15, OHIO
MAIN 4402

AUTOMATICS

No. 16 New Britain 6 spdl. chucking
No. 454 New Britain chucking
14"x19" Fay Chucking
8" Bullard 6 spindle Mult-Au-Matic
1½", No. 0G Brown & Sharpe
⅞" Acme Gridley Model R6
⅞" & 1¼" Cone 4 spindle
1" Economy shaver, hopper feed
1¼" Cleveland 4 spindle
1⅜" New Britain, Model 61
1⅞" Conomatic 8 spindle
2"x18" Cleveland Model B
2⅜" Acme Gridley Model RA6

BORING MILLS

100" Niles Bement Pond vertical
52" King vertical
24", 30" & 42" Bullard vertical
2½" bar, No. 25 Giddings & Lewis
3" bar, No. 3A Universal
3¾" bar, No. 5A Defiance
3¾" bar, No. 32 Lucas
5" bar Jones, planer table type
Nos. 112B & 2112 Excello precision
Nos. 42, 47A & 48A Heald Borematic

GRINDERS

10"x72" Colonial broach grinder
Nos. 33 & 35 Excello thread
Nos. 1 & 2 Brown & Sharpe univ.
10"x24" Landis hydr. universal
No. 2 Norton univ. tool & cutter
26", No. 22B Gardner disc
53", No. 37B Besly horiz. disc
No. 115 Gardner opposed disc
No. 230 Hanchett opposed disc
No. 2 Cincinnati centerless
No. 510 Oliver drill grinder
Nos. 6G & 10G Sellers drill grinders
Norton, 6"x18", 10"x36" & 23"x36"
Landis 6"x18", 14"x36"
No. 2B Brown & Sharpe surface
12"x48" Thompson surface
14"x60" Mattison surface
No. 34 Abrasive surface
16" & 24", No. 25A Heald surface
12" & 16", No. 22 Heald surface
Nos. 72A3, 72A5, 74 Heald internal
No. 72A3 Heald Sizematic
No. 72A3 Heald Sizematic centerless
Nos. 18A16, 18-28, 18-36 & 24-36 Bryant

LATHES

36"x18' Bridgeford
25"x48" centers Lebland
20"x8' Lodge & Shipley
18"x8' Rockford
16"x30" centers Monarch
16"x5' Sebastian
14"x6' Lodge & Shipley

LATHES, TURRET

Nos. 2, 4, 5, 1A & 3A Warner & Swasey
Nos. 5 & 7 Bardons & Oliver
Nos. 3, 4 & 3AL Gisholt
24" & 42" Bullard vertical
No. 62 Denver
No. 4 Midland
Nos. 2G & 3 Morey
3"x36" & 4"x34" Jones & Lamson

SHAPERS & PLANERS

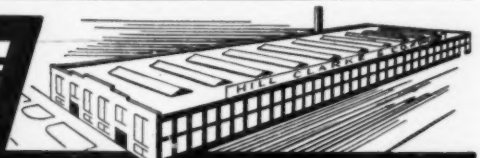
6" Pratt & Whitney vert. shaper
16" Bement Miles slotter
18", 20", 24" & 28" G&E shapers
20" & 24" Gemco univ. shapers
24" Columbia univ. shaper
30"x24"x8' Liberty openside planer

SHEET METAL TOOLS

8'x¼" Cincinnati press brake
8' x 10 ga. Dreis & Krump leaf brake
10' x 14 ga. Dreis & Krump leaf brake
8' x 10 ga. Beloit bending roll
No. 202½ V. & O. thread roller
72" x 14 ga. Wysong & Miles shear
80", 14 ga. Pettingell rotary shear
Nos. P1, P2, P3, P4, P5 Ferracute presses
Nos. 18 & 19 Bliss OBI presses
No. 8 American Can OBI press

MILES MACHINERY CO.
SAGINAW, MICH.

HILL-CLARKE MACHINERY COMPANY



ESTABLISHED 1867 • H. W. MONS, President • W. L. DITFURTH, Vice-President • T. H. PRICE, Secretary

PRESERVING LONG ESTABLISHED HIGH STANDARDS of accurate and dependable machine tools is job of Hill-Clarke's WORKS MANAGER, R. B. COLTER. With the firm for 27 years, he supervises Hill-Clarke's big 58,000 sq. ft. plant equipped with complete and modern facilities for REMANUFACTURING machine tools.

FOR YOUR PROTECTION only Hill-Clarke offers THIS 5 WAY GUARANTEE

1. A responsible organization—82 years' experience.
2. A 58,000 sq. ft. plant equipped with complete and modern facilities plus experienced craftsmen for REMANUFACTURING machine tools.
3. Modern machines—no worn out equipment.
4. You can see your machine tested under power before purchasing.
5. Hill-Clarke's unconditional money-back guarantee.

AUTOMATICS

No. 2 Brown & Sharpe
1½" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1⅝" (1942)
No. 6 Brown & Sharpe
No. 49 New Britain, 4 Spdl. chucker
Model A 2½" Cleveland
Model A 3¾" Cleveland (1942)

DRILLS

No. 150 Baker
No. D8 Colburn No. 6 Morse Taper
No. 1LMS—20"—5 Spdls. Leland-Gifford
No. 2LMS—28"—1 Spdl. Leland-Gifford
No. 2LMS—14"—3 Spdl. Leland-Gifford
No. 2LMS—36"—4 Spdl. Leland-Gifford
No. 2LMS—28"—6 Spdl. Leland-Gifford
No. 4BL Natco 36 Spdls.
6'-17" Col. Foodick Radial
7'-15" Col. American Full Universal

GEAR MACHINES

No. 61 Fellows Gear Shaper (1942)
No. 61-A Fellows Gear Shaper
No. 7125 Fellows (1943)
No. 712 Fellows Auto Indexing (1943)
No. 72 Fellows Gear Shaper
No. 16 HS Gould & Eberhardt
No. 18H Gould & Eberhardt
No. 6 Gleason Gear Tester
12" Gleason Bevel Gear Cutter
72" Cincinnati Gear Cutter

HORIZONTAL BORING MILLS

No. 31 Lucas, 3" bar
No. 46-B Heald Bore-Matic
No. 112—C Excello 2 Spdl.

GRINDERS

3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
Norton Motorized Grinders ranging from 6"x18" to 24"x240"
No. 5—8"x24" Covel Hydr. Surf. (1941)
No. 36-A Hanchett Rotary Surface
18" x 48" Mattison (1940)
72A-3 Heald Internal Grinder (1942)
72A-5 Heald Internal Grinder (1942)
74 Heald Internal Grinder (1942)
No. 5 Bryant Internal Grinder (1942)
No. 16-16 Bryant Internal Gdr. (1942)
No. 16-36 Bryant Internal Grinder (1942)
No. 24-26 Bryant Internal Grinder (1941)

LATHES

15"x5' Sebastian, Geared Head
16"x54" centers LeBlond (1941)
16"x60" centers Pratt & Whitney, Model B
18"x6' American, Grd. Head
19"-38" gap x 10' LeBlond
36"x30' Lodge & Shipley
36"—48"x16' Lehman Hydratrol (1945)
48"x20' centers Simmons (1942)
50"x17' centers LeBlond (1942)

LATHES (Production)

8"x15" Sundstrand, Model D (1943)
10"x16" Sundstrand, Model D (1942)
10"x22" Sundstrand, Model AA (1943)
16"x33" Fay Automatic (1942)
20"x25" Fay Automatics (1942)
R—14 Seneca Falls Lo-Swing

MILLING MACHINES

No. 4 Cincinnati Plain (1943)
No. 2 H Milwaukee Vertical (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cinn. Mfg. (1940)
No 2—18" Sundstrand-Electromil (1942)
No. M-24 Milwaukee Simplex (1942)
38"x40"x10' Fitchburg Duplex Miller (1943)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex
No. 45-48 Cinn. Hyd. Duplex
No. 46-72 Cincinnati Hydromatic (1942)
No. 58-72 Cincinnati Hydromatic
4½"x12" Pratt & Whitney, Model C
4"x9" Hanson-Whitney Univ. Thrd. Miller
6"x36" Lees-Bradner—Model HT (1943)
6"x48" Pratt & Whitney Thrd. Miller
6"x80" Pratt & Whitney Thread
6"x132" Pratt & Whitney Thread Miller
8"x168" Pratt & Whitney Thread
10"x48" Hanson-Whitney Thread
24"x24"x12' Ingersoll Adj. Rail
36"x36"x16' Ingersoll Slab Miller
No. 10 Ingersoll 72"x6' Traveling Column Face Millers (1942)

MISCELLANEOUS

18" Dill Slotter
Model H-7 Micromatic Hydro Honer
Model H-2 Micromatic Hydro Honer
Model 200 Micromatic Hydro Honer
8-M Wells Band Saw
Model H-100 Micromatic Hydro Honer
Model 200—H5 Micromatic Horiz. Hone
No. 2 V & O open back press
Baush Radial Tapper (1942)

PLANERS

36"x36"x12' Cincinnati
36"x36"x18' Gray, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

TURRET LATHES

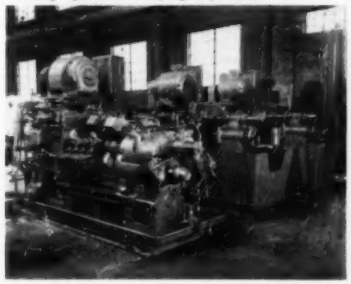
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4B Libby, Bar Feed (1942)
No. H-5 Libby
No. 5 Bardons & Oliver (1942)
No. 5 Midland, Bar Feed (1942)
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼" Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

VERTICAL BORING MILLS

42" Bullard New Era
42" Colburn
60" Colburn
72" Niles Extra Heavy
84" Betts

FEATURE OF THE MONTH

Big dollar savings with up-to-date production provided with these late model Fay Automatics, now ready for your inspection and operation. Hydraulically operated. Varying capacities.



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651 WASHINGTON BOULEVARD, CHICAGO 6, ILL. PHONE CEntral 6-0500

REDUCE PRODUCTION COSTS WITH CHOICE USED & REBUILT TOOLS

AUTOMATICS

Cannomatic 1⅞", 8 spindle
Cleveland, Model AA-08

BORING MILLS

Cleveland #1, 2½" bar, MD (Horiz.)
Lucas #41, 4½" bar, MD (Horiz.)
Bullard New Era, 24", Side Head, MD
King 54", one rail head, MD
Bullard New Era 36", Side head MD
Niles 36-44 Vert. Turret Side head MD
Bullard Maxi Mill 54", two rail heads, MD
DeHance #6 Horiz. 4½", MD

LATHES—ENGINE & PRODUCTION

American 14"x6'—14"x8', 3 SCD, BG, Bowl Head
American 16"x6'—16"x8', 3 SCD, D.B.G.
American 16"x6'—16"x8' GH, MD
American 18"x6'—18"x8'—18"x10' GH, MD
American 18"x8'—18"x10' 3 SCD, DBG, Bowl Hd.
Boye & Emmes 18"x6' SCEL
Boye & Emmes 18"x8' SCEL
Boye & Emmes 20"x10' SCEL

LATE TYPE

Boye & Emmes 16"x54" GH & QCG

Boye & Emmes 24"x16' HD, GH
Boye & Emmes 26"x16' QCG, MD
Boye & Emmes 40"x30' GH
Hendey 14"x6' Model EBM, Tool Room, MD
Hendey 14"x6' 4 SCD, Yoke head
Hendey 18"x8' 4 SCD, Yoke Head, Tool Room
LeBlond 14"x6'—14"x8' 4 SCD, BG
LeBlond 14"x6' GH, MD, BG
LeBlond 17"x6'—17"x8' GH, MD
LeBlond 17"x8' 3 SCD, Hi Duty, DBG
LeBlond 21"x6'—21"x10' HD, 3 SCD, DBG
Monarch 14"x6' 3 SCD, DBG
Monarch 16"x6'—16"x8' GH, MD
Monarch 18"x10' Model SBB16 Speed GH, MD
Monarch 20"x10' Model SBB16 Speed, GH, MD
Reed Prentice 16"x8' GH, MD
Sebastian 16"x8' 4 SCD
Lodge & Shipley 16"x6'—16"x8' Selective GH, MD
Lodge & Shipley 18"x8'—18"x10' Selective GH, MD
Lodge & Shipley 18"x54" centers GH, Latest Type
Lodge & Shipley 18"x8'—18"x10' 3 SCD, DBG
Sebastian 20"x8' GH, MD Very Late Type
American 24"x12', 2 speed GH, SCEL
American 24"x12' 8 speed GH, SCEL
American 24"x16', GH, SCEL, MD
Ohio 20" Back Geared 4 SCD
American 30"x26' GH, SCEL, MD
Lodge & Shipley 24"x14', SCEL, 3 SCD, DBG
LeBlond 25"x12' HD, QC, SPD, SCEL
LeBlond 25"x16', HD, 3 SCD, SCEL
Niles Timesaver 30"x10' (First Class Cond.)
Lodge & Shipley 36"x26', Patent Head, SCEL

GEAR CUTTERS

Gleason 3" Bevel Gear Generator, SPD
Gleason 6" Bevel Gear Generator SPD
Gleason 15" Spiral Bevel Gear Generator
Barber Coleman Model S for Precision Gears
Fellows #6I5 Helical Spur Gears MD
Fellows #6 Cuts internal & external
Pfauter #R2 Hobber, 40" Cap.
Gould & Eberhardt 36" S Automatic Gear Cutter
Gould & Eberhardt 18 H Gear Hobber, MD
Brown & Sharpe 26", 36", 48" and 60", SPD
Cross, #1 Gear Tooth Rounder

GRINDERS—ALL TYPES

Landis 4"x12" Type H, Plain Cyl.
Landis 10"x24" Type C Hyd. Univ., Latest
Landis 12"x72" Plain Cyl., M.D.
Landis 16"x72" Plain Cyl. Self Contained, MD
Landis 20"x220" Plain Cyl. Self Contained, MD
Landis Chaser Grinder, Model Y MD
Norton 10"x24" Type BA Plain Cyl. M.D.
Norton 10"x24" Type BA Plain Cyl. MD
Cincinnati 12"x48" Plain Cyl., MD
Brown & Sharpe #2 Univ., Belt Drive
Heald 72A3 Internal, Complete, MD
ExCell0 31L Precision Thread MD
Rivett 104-2, Internal MD
Cincinnati No. 3 Centerless
Gardner #120 A 51 Opposed Wheel Grinder Latest Type
Gardner #124-53 Horiz. Disc Grinder MD
Pratt & Whitney 10" Spiral Gear, 2 Wheel type
Thompson 6"x18", 6"x24" Type F Hyd. Surface
Norton 6"x18" Surface Grinder, MD
Arter Model A 3 12 Surface Grinder, MD
Heald 25A Rotary Surf Hyd. 16" Chuck, 1943
Gallmeyer & Livingston, 14"x18"x72" Model A Hyd.
Bridgeport #95—60° Face Grinder

LATHES—TURRET

Gisholt #3 Univ. Ram Type, New 1943
Gisholt, #3L, Saddle Type, Hardened Way, MD
Warner & Swasey #2A Hollow Hex
Warner & Swasey, #3 Univ. Late type
Warner & Swasey #3A Univ. Timken Bearing, MD
Jones & Lamson 3½"x32" Flat Turret, MD
Gisholt, #2L, Univ. New 1943

SHAPERS & SLOTTERS

Smith Mills 15" single pulley drive GB
Gould & Eberhardt 16", 20", 24" V ram, Cone drive BG
Gould & Eberhardt 16" Univ. MD
Cincinnati 18", 24" Back Geared, Cone Drive

GUARANTEED MACHINERY

Cincinnati Machinery Co., Inc.
219 East Second Street
Cincinnati 2, Ohio

AUTOMATICS—Natl. Acme 1⅝", four spindle, Bargain (2)

GRINDER—(Rotary) Blanchard 25" mag. chuck, belt—$500.00

HYDROHONER—Micromatic Model #4H (1943)

LATHE—So. Bend Tool Room, 14"x6' Taper, Late. Bamford-Chase Tool Room, 14"x6' Taper, Late. Bridgeford, Engine, g. head, 32"x21' centers.

MILLER—Plain K. & T. #4K, Late.

PLANER—Cleveland Openside 60"x60"x20', Late. Niles Bement Pond 48"x48"x26', 4 heads.

PRESSES—(2) Bliss #385, 100 ton, Late.
(2) Bliss #6, 125 ton, Late.
(1) Lake Erie, 750 ton, Hydraulic, Bed 72"x168" single or dible action, Late.

SHEARS—Niagara 10'x10 G, gap.
Barth (New) 54"x14 G.

WELDERS—(New) Sterling 10, 30 KVA, Bargain.

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LATE TYPE MACHINE TOOLS

SCREW MACHINE

GIBBS (Swiss type) model No. 375

WELDER

GENERAL ELEC. Atomic Hydrogen Arc Welder Mod. 6WK 20A1

WELDING POSITIONERS

RANSOME 3000 & 6000 lb. cap. head stock & tail stock type
RANSOME 6000 lb. Mod. 14, 46" sq. table Variable speed.
RANSOME 16,000 lb., Model 16, Constant Speed, 53" square table, 360° revolving, 90° tilting.
RANSOME 16,000 lb. Mod. 16, Variable Speed, 53" square table, 360° revolving, 90° tilting

CHIP CRUSHER

AMERICAN Model 1700 cap. 1-1½ T. per hour

RIVETERS

CHICAGO Rivet & Machine Co. Mod. 140
ERCO, Model 1002

X-RAY UNIT

G.E. One Million Volt Industrial Unit

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WALTER H. MEYER
Machinery and Equipment Co.
605 W. Washington Blvd., Chicago 6, Ill.

LATE TYPE MACHINERY

GRAY, 48"x48"x18' Double Housing Planer, new 1942, 4 heads, variable AC-DC drive, pneumatic tool lifters, exc. condition

DRILLS

ALLEN #2 Motor Spindle-2 sp.
CANEDY-OTTO 21" Box Col. Upright
LELAND-GIFFORD 1LMS Sing. Sp.
LELAND-GIFFORD 1LMS 6-spindle
LELAND-GIFFORD 2MS 2-spindle-power feed
LELAND-GIFFORD 2LMS-Single Sp.-Pw. Fd.

GRINDERS

NORTON 12"x36" Type C Universal Hydraulic Grinder, M.D., internal spindle, latest type, excellent condition

ARTER A3-12" Rotary Surface
BLANCHARD #11-20" Surface
B&S #1 (10"x20") Universal (2)
B&S #2 Auto. Feed Surface
CINCINNATI #2 Centerless
EXCELLO #31 Thread, M.D.
GRENBY IG-12 Internal
HEALD #72A3 Sizematic Internal
LANDIS 10"x24" Universal
LANDIS #4H 4"x12" Cyl.
NORTON 6"x18" Type C Cyl.
NORTON #2 Cutter and Tool
SELLERS Model #6T Wet Tool M.D.

ENGINE & TURRET LATHES

LEBLOND 13" Rapid Production
LODGE & SHIPLEY 16" 20"x30" 12-speed, sel. head
LODGE & SHIPLEY 18"x8' 12-speed, sel. head
LODGE & SHIPLEY 14"x30" Selective Head
MONARCH Model CAA 14"x54" geared head
SEBASTIAN 16"x8' Geared Head (NEW)
B&S #2 Wire Feed Hand Screw
GISHOLT #5 Univ. Turret-pres. hd-chucking
GISHOLT #3R Saddle Type Turret-bar & chucking
JONES & LAMSON Univ. Turret-pres. hd-chucking
W&S #2A Saddle Type Turret-chucking
W&S #3 Univ. Turret-air chuck
W&S #3A Saddle Type Turret-T.A.-cross sliding Turret-chucking

MILLING MACHINES

CINCINNATI Model #2-24 Rise & Fall Bed Type Production Miller-new 1944, all standard equipment-exc. condition

B&S #2 Light Type Universal
B&S #2 Light Type Plain
CINCINNATI #1-12 Knee Type Production
CINCINNATI #2 Dial Type Hi-Speed-Vert.
K&T #2HL Plain
K&T #2K Plain
K&T #3H Plain
K&T #2K Vert.
K&T #3H Vert.
"NICHOLS"—Hand (2)
LEES-BRADNER #40 Thread
VAN NORMAN #2S Plain
VAN NORMAN #3S Plain
VAN NORMAN #20 Ram Type Duplex
VAN NORMAN #22L Universal

MISCELLANEOUS

BLISS #4 Stiles Type Press—45 ton
CINCINNATI 10 gauge x 6' Press Brake. M.D.
FOSTER Superfinisher
NAT. ACME 9/16 RA-6 Automatic
POTTER & JOHNSTON #5DE Chucker
PRATT & WHITNEY #12B—2 spindle Profiler
ROCHESTER 3" Bar Hor. Boring Mill

Many Other Late Type Tools Not Listed
We Solicit Your Inquiries

UNITED MACHINERY & TOOL CORP.
85 Central St. Worcester, Mass.

MODERN
used and rebuilt
MACHINE TOOLS

AUTOMATICS

6" RPA-8 Acme Gridley Chucker, 1941.
16" Bullard Mult-Au-Matic, 6 spdl. 1942.
6" Goss & DeLeeuw Chucker, 8 spdl. 1943.
1⅝" Greenlee, 6 spindle, 1942.
No. 1½ B-18 Cleveland, 1940.
No. 60 New Britain, 6 spdl. 1" cap. 1942.
9/16" RA-6 National Acme. 1942.
9/16" RA-6 Acme Gridley Chucker. 1942.
Model 3-8 Ceco ⅜" Cap. Late.

BORING MACHINES

No. 42 Lucas Horiz. 4" bar. 1940.
No. 54 Excello Way Type Double End. 1940.
No. 2112A Excello Single End. 1943.
No. 46B Heald "Bore-Matic." 1941.
No. 49 Heald "Bore-Matic" Double End. 1942.
No. 49 Heald "Bore-Matic" Single End. 1942.
No. 47A Heald "Bore-Matic" Single End. 1942.

BROACHES

No. V2 American Vertical, 1943.
No. CPC 6-30 Lapointe Vertical. 1941.
Model XA Oilgear Horizontal, 60" stroke.

DRILLS, HEAVY DUTY

W6 Baush Hyd. Multipie Spindle. 1943.
25" Fosdick Economax. 1941.
No. 121 Baker Upright. Late.
21" Canedy-Otto. Like New.
No. 40 Fox Multiple Spindle. 1944.
No. 3 Baush Multiple Spindle.
Barnes 2 Spindle Deep Hole. 1943.
No. ½Bx50 P & W Deep Hole Drill. Late.
No. ½Bx50 P & W Deep Hole Reamer. Late.
No. ½Bx30 P & W Deep Hole Reamer. Late.
No. ½Bx50 P & W Deep Hole Rifler. Late.

DRILLS, RADIAL

4'11" American. 1943.
4'9" Cincinnati-Bickford. 1944.
3'9" Cincinnati-Bickford. 1946.
Baush Comb. Drill & Tapper. Late.
3' Leland Gifford Tapper. 1941.
20" Pfiffner Drillmaster. 1942.

DRILLS, SENSITIVE

15" Atlas, 4 Spindle. 1942.
14" Delta, 4 Spindle. 1942.
No. 2 MS Allen, 1 to 3 spindle. 1942.
No. 2 Hamilton-Muehlmat. 1943.

GEAR EQUIPMENT

No. 12 Gleason Gear Rougher. 1943.
No. 17 Gleason Gear Tester. 1943.
3" Gleason Bevel Gear Gen. 1942.
No. 6 Gleason Tester. 1942.
No. 7 Gleason Revex Cutter Sharpener. 1942.
No. 12 Gleason Tool Sharpener. 1942.
No. 140 Cleveland Rigidhobber. 1942.
Vinco Spline & Gear Grinder. 1942.
No. 7125A Fellows Gear Shaper. 1943.
No. 715 Fellows Gear Shaper. Late.
No. 712 Fellows Gear Shaper. 1942.
No. 860B Michigan Finisher. Late.
12" Red Ring Internal Shaver. Late.
No. CCL-3 Red Ring Shaver. 1942.
15" Red Ring Lapper. 1942.
10" Red Ring Gear Speeder. Late.
Red Ring Universal Gear Checker. 1942.

GRINDERS, CYLINDRICAL

16"x36" Cincinnati Plain. 1942.
14"x36" Norton Type C Universal. 1943.
12"x48" Cincinnati Universal. 1943.
10"x72" Landis Type C Plain. 1942.
10"x72" Norton Type C Plain. Late.
10"x24" Landis Type C Universal. 1942.
10"x18" Norton Type C Plain. 1942.
6"x30" Cincinnati Plain. 1943.
6"x24" Norton Plain. 1936.
6"x18" Cincinnati Plain. 1942.
6"x18" Landis Type C Plain. 1941.
6"x18" Norton Type C Plain. 1942.
4"x12" Landis Type H Plain. 1944.
No. 5 Brown & Sharpe Plain. Late.
No. 2 & 3 Cincinnati Centerless. 1942.
16x72 Norton Crankshaft Grinder.

GRINDERS, INTERNAL

No. 16A22 Bryant Hydraulic. 1943.
No. 81 Heald "Sizematic." 1942.
No. 74 Heald Extended Bridge. 1941.
No. 75A Heald Two Motor. 1943.
No. 72 A3 & A5 Heald Plain. 1944.
No. 50 Heald Plain. 1941.
No. 5 Bryant Internal. Late.
No. 104 Rivett Internal-External. 1943.

GRINDERS, SURFACE

14"x36" Pratt & Whitney Vert. 1938.
6"x18" Robot. 1942.
No. 2B Reid. 1944.
No. 2-3 Reid. Late.
No. 25A Heald Rotary. 1942.
No. 22 Heald Rotary. 1943.
A1-8 Arter Rotary. 1942.
6" Taft Peirce Rotary. Late.

GRINDERS, MISCELLANEOUS

72" Lapointe Broach Grinder. 1941.
72" Thompson Broach Grinder. 1941.
72" Rogers Knife Grinder. Late.
No. 22 Covel Universal. 1942.
No. 91A Covel Universal. 1942.
No. 4T Sellers Carbide. 1942.
Barber Colman Comb. HRS. 1943.
Sundstrand Carbide. 1942.
No. 2 LeBlonde. Late.
No. 6-G Sellers Drill Grinder. 1942.
No. 13 Brown & Sharpe Universal.
No. 44 and 48 Excello Carbide. 1942.
Milwaukee Face Mill. 1942.
No. P5 Bura-Way Carbide. 1942.

LATHES, ENGINE

42"x192" Axelson. 1942.
24"x168" Sidney. 1942.
18"x54" Lodge & Shipley. 1943.
18"x48" Bradford. 1942.
14"x78" Reed Prentice. 1942.
14"x54" Reed Prentice. 1942.
14"x30" Bradford. 1942.
14"x30" Lodge & Shipley. 1943.
14"x6' Hendey.
12"x36" Sebastian. Late.

LATHES, PRODUCTION

20"x25" Fay Automatic. 1942.
14"x42" Monarch "Magna-Matic". 1941.
12"x18" Lipe "Carbe." Latest.
10"x21" Sundstrand, Model 10. 1942.
9"x20" Lipe High Speed. 1942.
8"x36" Lo-Swing Semi-Auto. 1942.
8"x21" Fay Automatic. 1942.
8"x15" Sundstrand, Model 8. 1942.
Model IMF & R Lo-Swing. 1942.

LATHES, TURRET

36" Bullard Vertical. 1945.
No. 3A Warner & Swasey. 1943.
No. 2A Warner & Swasey. 1942.
No. 9A Jones & Lamson. 1942.
No. 3L Gisholt. 1941.
No. 2FU Foster "Fastermatic". 1943.
No. 1 Acme Universal. 1941.
No. 8½"x24" Acme Universal. 1943.
No. 2, 3, 4 and 5 Warner & Swasey. 1942.
No. 2, 3, 5 & 7 Bardons & Oliver. 1943.
No. 3 and 4 Gisholt. 1943.
No. 2L Gisholt.
No. 2A Warner & Swasey.

MILLING MACHINES, PLAIN

No. 5 Cincinnati. 1943.
No. 4K Milwaukee. Latest.
No. 4H Milwaukee Latest.
No. 3B Brown & Sharpe. 1941.
No. 3 Van Norman. 1942.
No. 2HL Milwaukee. 1942.
No. 2L Van Norman. 1942.
No. 2B Brown & Sharpe.
No. 3 Cincinnati.
Nichols Hand Mill. 1942.

MISCELLANEOUS

No. 35 Excello Univ. Thread Grinder. 1943.
6'x½" Bertsch Bending Roll. Late.
6'x14 Ga. Pexto Power Shear. 1941.
10'x14 Ga. Chicago Press Brake. Late.
No. 405 Williams Turnings Crusher. 1943.
200 lb. Bradley Helve Hammer. 1941.
No. 7B High Speed Riveting Hammer. 1942.
PO-14 Jones & Lamson Comparator. Late.
50 KVA Federal Spot Welder. 1942.
No. 616 Cleveland Rigidturner. Late.
No. 26F Norton "Hyprolap". 1942.
No. 1 Savage Roller Type Nibbler. New.
No. 3U Gorton Pantograph. Like New.

PLANERS & SHAPERS

52"x36"x40' Cincinnati Planer.
36"x36"x16' Ohio Planer.
24" American Crank Shaper.
20" Gould & Eberhardt Shaper.
16" Gould & Eberhardt Shaper.
12" New Haven Vertical Slotter.
6" Pratt & Whitney Vertical Shaper.

PRESSES

100 Ton Hannifin Hydraulic. 1942.
50 Ton Denison Hydraulic. Late.
45 Ton Reliance. 1942.
No. 8-6 Zeh & Hahnemann. 1942.

SAWS

14"x20" Racine "Shear-Cut". 1942.
13"x13" Peerless Universal. 1943.
No. 302 Campbell Abrasive. Late.

MILLING MACHINES, PRODUCTION

No. BL-2420 P & W "Keller", 3 Spindle. 1942.
No. BL-2416 P & W "Keller", 1 Spindle. 1943.
No. BG-1 "Keller", Single Spindle.
No. 1248 Milwaukee "Simplex". 1942.
No. 4-48 Cincinnati Hydromatic. 1943.
No. 4-36 Cincinnati Hydromatic. 1942.
No. 2-18 Cincinnati, Plain. 1942.
No. 1-18 Cincinnati, Plain. 1942.
No. 12 Brown & Sharpe. 1942.
No. 2-20 Kent Owens. 1942.
No. 1-14 Kent Owens. 1943.
No. 08 Cincinnati, Rise & Fall. 1942.
No. 08 Cincinnati, Plain. 1942.
No. MM-1-5-2 U.S. Multi-Miller. 1943.
No MM-1-6 U.S. Multi-Miller. 1942.
No. 0, 00 & 2 Sundstrand "Rigidmil". 1943.

MILLING MACHINES, THREAD

6"x60" Pratt & Whitney. Late.
12"x54" Lees-Bradner. 1943.
8"x16" Hanson Whitney. Late.
4½"x12" Pratt & Whitney. 1942.
4"x9" Hanson Whitney. Late.

MILLING MACHINES, UNIVERSAL

2MH Cincinnati. 1942.
No. 2L Cincinnati. 1941.
No. 2H Milwaukee. 1942.
No. 2SU Van Norman. 1942.
No. 26SU Van Norman. 1942.

MILLING MACHINES, VERTICAL

No. 3K Milwaukee. 1942.
No. 3H Milwaukee. 1940.
No. 3 Cincinnati. 1942
No 2K Milwaukee 1942.
No. 2 Cincinnati. 1940.
No. 2 Milwaukee.

ALL MACHINES MAY BE INSPECTED UNDER POWER IN OUR WAREHOUSE

HIGH QUALITY
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MACHINERY & SUPPLY CO.

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MEXICAN OFFICE AND WAREHOUSE
Independencia 36-B, Mexico, D.F.

HEADLINERS

LATHES

12"x30" MONARCH Model C Tool Room
14"x8' AMERICAN 12-speed Grd. Hd., AC MD, Taper
18"x12' LODGE & SHIPLEY Selec. Grd. Hd., AC MD
20"x8' LODGE & SHIPLEY Selec. Grd. Hd., AC MIB, taper
22"x10' ROCKFORD 3 SCD DBG bowl hd.
24"x12' BOYE & EMMES, AC Turner Uni-Drive
24"x12' AMERICAN Grd. Hd., AC MD, taper
24"x14' LODGE & SHIPLEY, Turner Drive, Taper
30"x16' LODGE & SHIPLEY, Lima Drive, taper

MILLERS

#1—18" CINCINNATI Auto. Plain, backlash elim., 1943
Type "P" OHIO Production Miller, new 1943
#2 CINCINNATI H.P. Rect. O/A Plain, AC MIB, PRT, Timken
#2B MILWAUKEE Plain, AC MD, DOA
#3B MILWAUKEE DOA Plain, AC MIB, PRT
#4 CINCINNATI H.P. Univ., Lima Drive, div. hd., slot attach.
#4 CINCINNATI H.P. Rect. O/A Plain, PRT, AC MD
#5 CINCINNATI H.P. Rect. O/A Plain, PRT, AC MD

SHAPERS

24", 28", 32" GOULD & EBERHARDT High Duty
28" AMERICAN H.D., AC MD
32" CINCINNATI Hvy Duty, AC MD

RADIAL DRILLS

4' MORRIS Enclosed Head, AC MD
6' CINCINNATI-BICKFORD mtr. on arm
7' DRESES, 17" col., AC MD thru gearbox

GRINDERS

#3 ABRASIVE Surface, AC MD
#25A HEALD Rotary Surf., AC MD
10"x24" LANDIS Type C Univ. Hydr., new 1943

BORING MILLS

#3A UNIVERSAL Horz. 3" bar, SPD
#43 LUCAS Horiz., AC MD, 4½" bar, 20' betw. faceplate & outer support
38" KING Vert. Boring Mill, AC MD

GEAR MACHINERY

#12H GOULD & EBERHARDT Hobber, AC MD
#18 GOULD & EBERHARDT Hobber, AC MD
#34 BROWN & SHARPE Hobber, AC MD

TURRET LATHES

#4-W CINCINNATI ACME Univ., AC MD, thread chasing
#4 WARNER & SWASEY Univ. Grd. Hd., AC Mtr. in leg
#5 WARNER & SWASEY Univ. Grd. Hd., AC MD
#601 OSTER "Rapiduction," AC MD, bar feed

MISCELLANEOUS

#4 WATERBURY-FARRELL Thread Roller, AC MD
2½" LANDIS Dbl Hd., Bolt Threader, AC MD
10" PRATT & WHITNEY Vert. Shaper
10' x 16 ga. CHICAGO Steel Leaf Brake, AC MD

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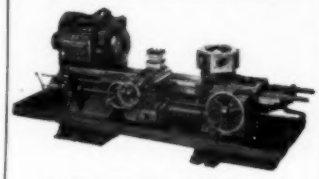

No. 3A WARNER & SWASEY, serial 816000, electric chuck, tooling

16"x54" LE BLOND Toolroom Lathe, 1943
20"x10' AMERICAN High Duty 12 Speed Timken Head, taper attachment, M.D.
36"x18' LODGE & SHIPLEY 18 Speed Geared Head Lathe, taper attachment, chuck, M.D.
42"x96' AMERICAN 16 Speed G.H. Engine Lathe
48"x28' DRIGGS (NEW HAVEN) G.H. Lathe
24"—36"—42" BULLARD Vertical Turret Lathe
No. 5 BARDONS & OLIVER Turret Lathe, bar, chucking, taper attachment, 1942
No. 1224 KEARNEY & TRECKER Simplex Miller, 1943
No. 2K KEARNEY & TRECKER Universal Mill
No. 1S CINCINNATI Universal Mill, rectangular overarm, motor in base
No. 3 CINCINNATI Plain Mill, rectangular overarm, motor in base
42"x42"x12' INGERSOLL Adjustable Rail Planer Type Mill, 4 heads, 25 HP motor
24" GOULD & EBERHARDT "Industrial," 1940
32" OHIO Heavy Duty Shaper, 1942
6' CINCINNATI GILBERT Radial, 12" column, motor on arm
No. 5 NEWARK Universal Gear Hobber, 72" cap.
84" CONSOLIDATED COLBURN Vert. Boring Mill, rapid traverse, 2 heads, A.C.—M.D.
No. 32 LUCAS Hor. Boring Mill, A.C.—M.D.
No. 7 BARRETT Cylinder Borer, 6" bar
10'—¼" CLEVELAND Shear, „4" gap, M.D.
10'—¼" HILLES & JONES Pyramid Bending Rolls
No. 5 HILLES & JONES Beam Punch

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1/4"-20, 1/4"-28, 5/16"-18, 5/16"-24, 3/8"-16, 3/8"-24, 7/16"-14, 7/16"-20.

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Milling Machines—No. 1, Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 3—26" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 16"x36". Surface 12"x52", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x6', 8', 10'—10"x6', 8', 10'—18"x6', 8', 10'—26"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 19" and 18" bench and floor type.

Planers—Single head 24"x6', 24"x8', 26"x8'.

Shapers—16", 20", 24", B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36", also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled, ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 5¾" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

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9/16", 1", 1¼", 1⅝", 2", 2¼", 2⅝" Asme Gridleys, late
#0G B & S, late type
1½" & 1⅝" 8 Spdl. Cone, late
2¼ & 2⅝" Cone 6 Spdl., late
12" and 16" 8 Spdl. Bullard Multaumatics, late

PRESSES

2800 ton Bliss Hydr., 3 col. type, 12" str., 58½" sht. ht., dia. bed 115"
60 ton Dbl. Crank, 5" stroke, 48x24 bed, late model Waterbury Farrel
90 ton Dbl. Crank, 8" stroke, 48x18 bed, late model Bliss
35 ton 4, 6, 8" stroke, latest type, w/all accessories, Bliss $850.00 ea.
70-85 ton 4" stroke 21 x 27 bed, 110 strokes per min., Bliss, latest type
90-125 ton 4½" or 5" stroke, 60, 90, 110 (optional) strokes per min., late type
Inclinable, New, 20 to 70 ton, immediate delivery
375 ton Elmes, 12" stroke, 84x54 bed, late type
350 ton Elmes, 20" stroke, 36x45 bed, late type
250 & 750 Baldwin, 144x48 bed, 40" stroke
#305 Bliss, 12" stroke, late

TURRET LATHES

#3 & #5 Warner & Swasey, late type w/Tools
#4FU Fastermatic, 4" cap., late type
#3H8 Libby Sliding Bed Gap, 8¼" cap., late type 72" swing, 30 H.P. Mtr.

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CINCINNATI GILBERT 3½" bar, floor type, latest
DETRICK & HARVEY 4" bar, Floor Type, M.D.
GIDDINGS & LEWIS #2T, 2½" Bar—latest
GIDDINGS & LEWIS #45, 5" Bar, Table Type, latest
LUCAS #41, 3" bar, Table Type, Latest Type
NILES BEMENT POND 5", 6", 8" bar, fl. type, M.D.
UNIVERSAL 4" bar, high speed, latest type
BORING MILLS—Vertical
BETTS 120", 2 swivel heads, AC, Motor Drive
BULLARD 16", 6 spindle Multiautomatic, Latest Type
BULLARD 24", 36", 54" "Spiral Drive", Latest
BULLARD 61" "Maxi-Miller", 2 heads, Motor Drive
KING 62", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, PRT, DC, M.D.
DRILLS
AMERICAN 3' arm 9" column, "Hole Wizard", latest
AMERICAN 4' arm 11" column, "Hole Wizard", latest
LELAND & GIFFORD #1LMS, 4 spindle, latest
LELAND & GIFFORD #2LMS, 6 spindle, latest
GEAR CUTTING EQUIPMENT
FELLOWS 5" #01, #7, #7A, #12, #15, #17 High Speed Gear Shapers, latest type
FELLOWS #2, #2Z, Gear Shaper, latest
GLEASON 5", 12" straight bevel generator, Latest
GOULD & EBERHARDT #12H, Hobber, Latest
GOULD & EBERHARDT #30H, Hobber, with diff., M.D.
GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
LANDIS 4x12, Type H Plain Hyd., Latest
NORTON 6x18", 10x72", 11x36" Type C Plain, latest
NORTON 6"x20", 10"x36" type C, Plain Hydr., Latest
GRINDERS—Miscellaneous
BRYANT #16-CP-16, #24 Int. Hyd., latest
CINCINNATI #2 Centerless "Fibmatic," latest
CINCINNATI Centerless Lapper, Model ED, Latest
COVEL #22 Universal Tool & Cutter, Latest Type
HEALD 75A, 72A, 72AA, 71, 69A Internal, latest
LANDIS #12 Centerless, Hydraulic latest type
GRINDERS—Surface
HANCHETT Series 300, 12x18" Vert. spdl. hyd., latest
HEALD #22 Rotary, 12" chuck, latest type
HEALD 25A—rotary—10" and 20" chuck, hyd., latest
THOMPSON 12x12x24 Model B Hyd., Latest Type
THOMPSON 12x12x40 Model B Hyd., Latest Type
LATHES—Engine & Mfg.
AMERICAN 36"x200" centers, 2 carriages, motor dr.
LEHMANN 16x30" centers, TIMKEN, latest type
LeSWING 4x80, 4x8L, 8x60, 8x10S, 5x34, Latest
MONARCH 12"x54" centers, Timken, Latest Type
MONARCH 10"x20" centers, Model EE, Timken, latest
MONARCH 16"x78" centers, Timken, Latest type
MONARCH 22"x156" centers, Timken, M.D.
NILES 30x30" Boring, Timken, Latest Type
PRATT & WHITNEY 14"x54" centers, 16"x30" centers, Type C, Timken, Latest
SPRINGFIELD 16"x30" centers, Timken, Latest Type
WARD, HAGGAS & SMITH—18/30x96" centers gap.
LATHES—Turret
BARDONS & OLIVER #3, #7, Timken, Latest Type
FOSTER #4FU "Fasternatic" Timken, Latest
GISHOLT #1L, #2L, #3L Universal, Timken, Latest
GISHOLT #2, #4 Univ., TIMKEN, Latest Type
JONES & LAMSON #3, #5 Univ., Timken, Latest
LIBBEY "International" 1-H, Univ., Timken, latest
MOREY No. 2G, No. 3, No. 4, Timken Bearing, latest
POTTER & JOHNSTON #5D, #5DE, Timken, latest
WARNER & SWASEY #1, 2, 3, Ram—Timken, latest
WARNER & SWASEY #2A Universal, Timken, Bar & Chucking, Latest Type
WARNER & SWASEY No. 4A, 8" bar, serial over 1,000,000, Latest Type
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BROWN & SHARPE #2, Light Type, Timken, latest
BROWN & SHARPE 2B, 3B, Timken, Latest Type
CINCINNATI 0-8 Auto., Rise & Fall, Latest Type
CINCINNATI #2 DMKN, Motor Drive
CINCINNATI 4-36, 2-18 Hydromatic, Simplex, latest
KEARNEY & TRECKER 2H, 3H, 4H, Timken, latest
KEARNEY & TRECKER #3, 4, Hyd., Timken, M.D.
KEMPSMITH #3G, Timken, latest type
KEMPSMITH #1 Maximiller, Timken, latest type
MILLING MACHINES—Vertical
BROWN & SHARPE #2, Timken, latest type
CINCINNATI #2 Dial Type, Timken, latest type
GORTON #8½D, 9J high speed, latest
KEARNEY & TRECKER #3H, Timken, Latest
REED PRENTICE 3VG, with Indicrator, Latest
SCREW MACHINES—Automatic
BROWN & SHARPE #2G High Speed, Latest Type
CLEVELAND 9/16", 1½", model A, high speed, latest
CONOMATIC 6", 4 spindle, latest type
CONOMATIC 2¾"—6 spindle, Latest Type
GOSS & DeLEEUW 8" auto. Chucker, 5 spindle, latest type
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AJAX 2", 3½" Forging and Upsetting, M.D.
AMERICAN V-2, 6 ton 26" stroke Vert. Broach, latest
BARNES #112, 206H, 307 Vertical Hone, Hydraulic, Self-Oiling, Latest Type
CINCINNATI 1-50, 3-50 Duplex Vert. Surface Broach, Double ram, Model ER, Hyd., Latest Type
FOSDICK Model 52 Jig Borer latest type
LAKE ERIE 700 ton Vertical Hydraulic Press, latest
MICHIGAN #1708A Cutter Reliever, Latest Type
NILES "Time Saver" 48"x48"x12" Planer—3 heads, Box Table, P.R.T., Latest Type
PRATT & WHITNEY (KELLER) Type BL-2416 & Type G Copying, latest type, 2 & 3 Dimensional
PRATT & WHITNEY ½-Hx50 Rifler, Latest Type
PRATT & WHITNEY 6' x 60 Thread Miller, latest
QUICKWORK 3½" x 17" cap. Rotary Shear—M.D.

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Niles Bement & Pond 6' Radial.
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Norton 6" x 10" x 36" Surface.
Norton 15" x 17" x 72" Surface.
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Landis No. 3 M.D. inside radius.
Cincinnati Nos. 2 & 3 Centerless.
Cinn. 12"x36" Univ. M.D. Late.
Cinn. 12"x24" Univ. M.D. Late
Cin. No. 2 M.D. Univ. Cutter & Tool.
Landis 4" x 18" Type H, Pl. M.D. Hyd.
Blanchard No 16—26" and 16A.
Heald No. 25A—16" Rotary Surface.
Heald Nos. 70A and 72A Internal.
Abrasive Nos. 33, 3 & 34 Sur.
Pratt & Whitney 14" B.B. Vert. M.D.
Norton Type "C" 6" x 18" M.D. Hyd. Cyl.
Norton 10" x 24" M.D. Plain Cyl.

LATHES
Lodge & Shipley 36"x16' M.D. G.H. Q.C.G. Eng.
Johnson 36" x 36' B.G. L.C.G. Eng.
Monarch 12" x 30" C.K. (Swings 18").
Hendey 12" x 3' Y.H. Fact M.D.
Hendey Plain 12", 14", 16", 18" Yoke Head.
American 24"x12' M.D., G.H., Q.C.G. Eng.
American 30" x 15' G.H. M.D. Q.C.G. Eng.
American 30"x25' G.H. Q.C.G. M.D. Eng.
Hendey 24"x8' M.D. Q.C.G. Eng.
Hendey 12"x5' M.D. Geared Head.

MILLERS
K & T 3K Vert. Sliding Head M.D. Late.
K & T 2H D.O. M.D. Plain Late.
K & T 2H Vert. Sliding Head, M.D. Late.
Milwaukee No. 1½B Univ. M.D.
Cincinnati No. 2 Univ. Rect. Overarm
Cincinnati 0-8 M.D. Prod. Late.
Milwaukee No. 3B Univ. D.O.
Brown & Sharpe No. 3A Univ.
Cincinnati 2 & 3 Vert.
Van Norman 3SP Plain.
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Brown & Sharpe No. 2B and 3B Plain.
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Gorton 9J Vert. Late.
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Gorton 8D M.D. Vert. Miller.
Sundstrand No. 3 M.D. Rigidmil
Brown & Sharpe No. 21 Plain Auto.

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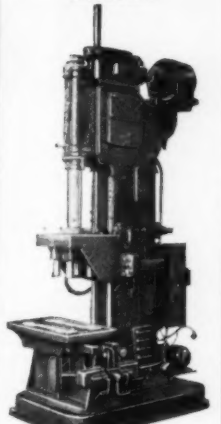

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Bliss No. 315 O.B. Geared Power
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Bliss No. 304 M.D. S.S. Single Crank.
Bliss No. 52 2¼ Stroke B.G. M.D. S.S.
Stoll No. 4 Double Crank.
Bliss #33¾A Toggle
Diamond No. 30, 30 Ton M.D. O.B.I. 3" St.
Walsh No. 4 3½" St., M.D. O.B.I.
Pexto No. 16 O.B.I. 2½" St., 48 Ton

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B&S #00G, 0G & 2G Auto. M.D.
Brown & Sharpe Nos. 00, 0, 2, 4 & 6 Auto.
Brown & Sharpe Nos. 1 & 2 Hand.
W&S Nos. 1, 2, 2A, 3A Univ.
Foster No. 7 and No. 7B.
Gridley 7/8", 1¼", 1¾" and 2⅝" Model "G."
Cleveland 2½" Model K.
J & L No. 5 M.D. Turret. Late.
Acme 6W M.D. Turret. Late.
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32"x32"x10' Whitcomb Planer, 2 heads
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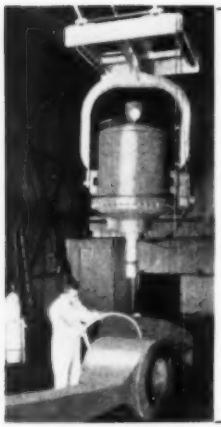

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1 Wickman Profile Grinder—Serial #WG-88, complete with 1 circular form tool grinding attachment—440 volts, 60 cycle, 3 phase.

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28-60 Cinci. Hydrotel, one spin., 1943
BL 2416 Keller 3 spin. Duplicator, table 22"x42", 3 dimensional
Model 9J Gorton Electric Duplicator, 3 dimensional
Model 9J Gorton Vert. Miller, power feed to head
Bridgeport Vert. Miller, power feed, shaping attach.
(2) Bridgeport Vert. Millers
Indexing Vert. Miller
#3K K. & T. Plain Miller, with vert. attach. & Rotary table
3'9" col. American Hole Wizard Radial
#45 G. & L. Surface Grinder, 12"x24"
16" G. & E. Tool Room Shaper, 1943
#2 B. & S. Surface Grinder, 1943
Cinci. Monoset Grinder
(2) 9" Hardinge Bench Lathes
24" Foote-Burt Drill, #2 M.T.

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SPECIAL SALE MACHINERY

1—only Automatic Dieing Machine "Henry & Wright" Ser. 30708, 1½" Stroke, 8½" Shut Height, Belt Drive. 150 R.P.M., 25 Ton. Driven by: 3 H.P. 25 cycle, 3 phase 550 volt motor.

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The above equipment is of late type, and in excellent condition. Submit inquiries to:

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2—Ledge & Shipley Duomatic lathes
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1—Monarch Lathe, 22 x 48"
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MILLERS FOR SALE

CINCINNATI #3, #4 Vertical, Motor Drive
CINCINNATI #3, #4, Plain rect. overarm M.D.
INGERSOLL 30x24x12" Planer Type M.D.
KEARNEY & TRECKER #2 Plain Miller, M.D.
KEARNEY & TRECKER #4 Heavy Timken M.D.
SUNDSTRAND 3A Duplex, Timken, Latest
VAN NORMAN #3, Duplex Universal M.D.

HARRISON MACHINERY EXCHANGE, INC.
South 4th St. Harrison, N. J.
Tel.: HUMBOLDT 2-5750, 2-5775

Defiance #25A horizontal boring mill, 3½" bar, 1940
Cincinnati #3 Centerless grinder, filmatic bearings, 1942
K&T #3H plain dial type horizontal milling machine, 1941
Cincinnati #2MH universal milling machine, dividing heads, rotary table, 1942
Cincinnati #4 plain dial type horizontal milling machine
Gisholt #3 universal turret lathe 2½" capacity, bar and chucking, 1943
Bardons & Oliver #3 universal turret lathe, 2" capacity, bar, 1942
Gisholt #3 universal turret lathe, 1½" capacity, bar & chucking, presselector, 1942
Bardons & Oliver #3 universal turret lathe, 1½" capacity, bar 1941
Waterbury Farrel 20 ton 4 post hi speed blanking press, 1½" stroke, 1941

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Mitchell 3-7608

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Micromatic Vertical Hydrohoner Cap. ⅞"-3" Dia.
No. 1 LeBlond Crankshaft Lathe
Tocco Induction Hardener 30 Kw
Norton 10x18" Crank-O-Matic Grinder
G.E. Engine Testing Dynamometer 10 HP Absorb and other miscellaneous small engine manufacturing equipment.

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Late Type #1L Gisholt Saddle Type Turret Lathe with cross sliding turret. May be inspected under power.

Price $4,500.00

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1—35 GISHOLT DYNETRIC BALANCING MACHINE

Machine arranged for balancing parts from 10 to 200 lbs. in weight—24" or less max. dia.—24" or less in length between bearing shoulders. Machine in excellent condition.

GATES and COMPANY Milwaukee 3, Wis.

FOR SALE

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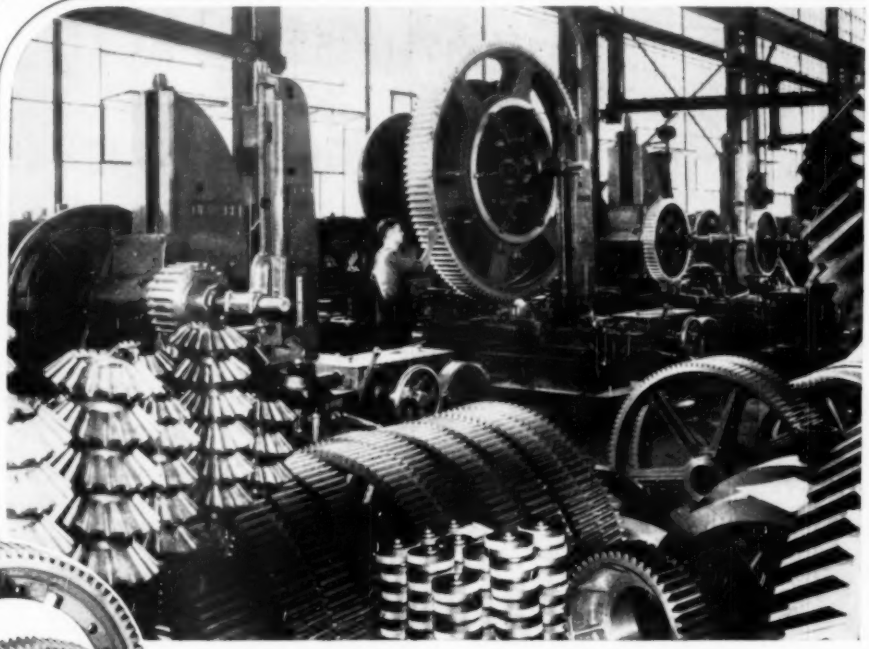

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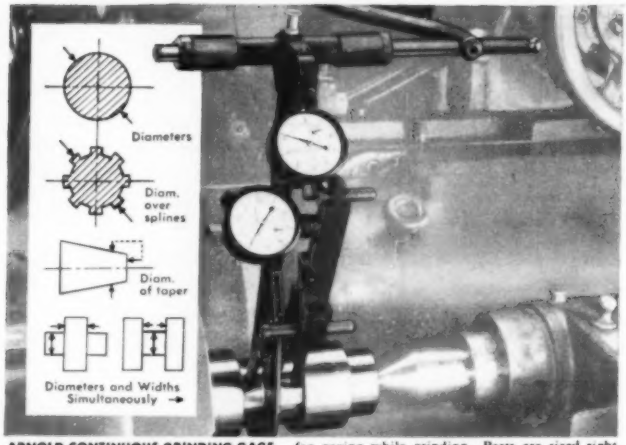

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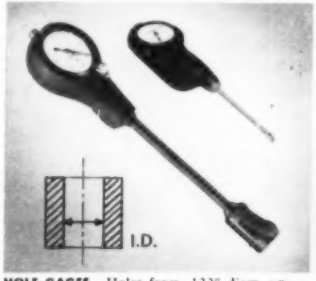

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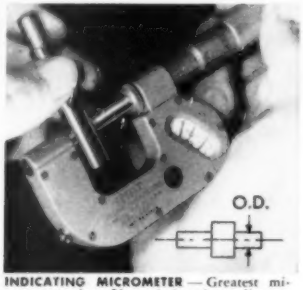

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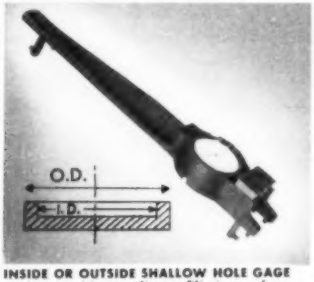

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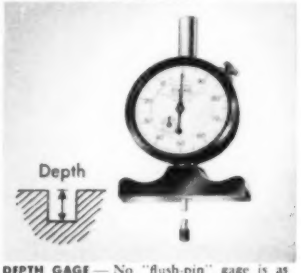

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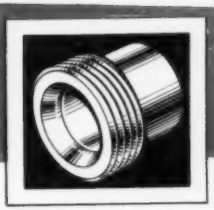
In the customer's own words...

Here's how New Britains produced a better method



Part Machined – 3/4" Union Female End

	OLD METHOD	NEW METHOD
TYPE MACHINE & MODEL	[redacted] Hand Screw Machine	New Britain Model 656 Automatic Chucker
PRODUCTION PER 8 HR. DAY	375	1400
INCREASE IN PRODUCTION	—	400%
OVERHEAD	75% of cost per piece	50% of cost per piece

". . . we are now making the male end on the Model 656 too, and converting our New Britain Model 467 to second operation work. We also completely machine a union coupling nut on a specially adapted Model 675 New Britain with comparable savings. We are also interested in getting a quotation on a Model 88 New Britain Automatic."

CATAWISSA VALVE & FITTINGS CO.

C. L. Davis
Plant Engineer

THE JOB: Eleven operations are performed by a six spindle New Britain Automatic, in facing end, chamfering both sides of thread diameter, drilling through piece and finishing seat, turning thread diameter and threading O.D.

There's a *better method* to be found in every shop — dozens of them in most.

Find them and you have the surest way to keep your costs at competitive levels. The New Britain sales engineer in your area can help you with them. Why not give him a shot at some of the problem pieces you make? Write us direct for "IT CAN BE DONE" — cost histories on many actual pieces. It's packed with production ideas.

NEW BRITAIN
Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT

549HG1

A lot of heads together... but not a bit of chatter!

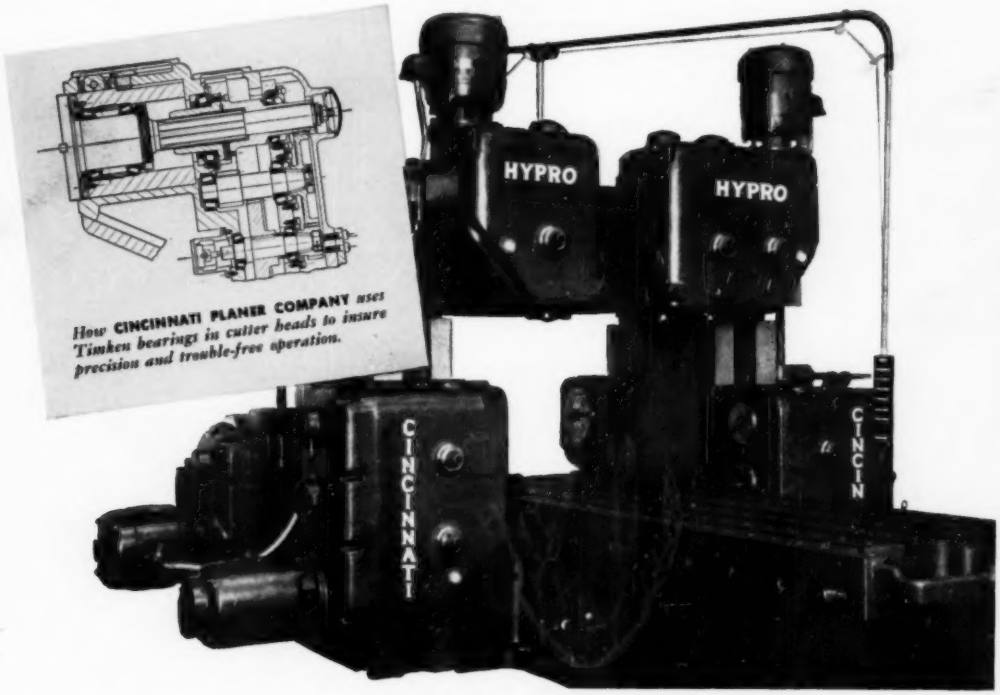
SIX milling heads, controlled by new electronic drive, are features of this planer type milling machine made by the Cincinnati Planer Company. To insure precision and prevent chatter, sixty Timken® bearings are used to keep shafts in rigid alignment under the heaviest loads. Timken tapered roller bearings carry any combination of radial and thrust loads without deflection or end-movement.

The rolls and races of Timken bearings are made of Timken fine alloy steel—then case-hardened to give them a wear resisting surface. The line contact between rolls and races provides maximum load carrying capacity.

Because Timken bearings are finished to extreme precision and almost incredible smoothness, friction is eliminated.

Remember, no other bearing can give you *all* the advantages you get with Timken tapered roller bearings. Be sure you have them in the machine tools you buy or build. Look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, O. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **CINCINNATI PLANER COMPANY** *uses Timken bearings in cutter heads to insure precision and trouble-free operation.*

NEW TIMKEN BEARING CUTS RUN-OUT IN HALF!

Until now, the Timken "Zero" bearing has been the last word in bearing accuracy. Now Timken offers industry the "Double-Zero" bearing—*twice as accurate* as the "Zero"! Maximum run-out of the new "Double-Zero" bearing is only 75 millionths of an inch—*half* the 150 millionths run-out of the "Zero" bearing.

What an opportunity for manufacturers of machines where extreme accuracy is essential! Available in standard single row types, up to 10" O.D. Write for further information.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION